5534

Walk Around

Messerschmitt Bf 109E

Walk Around Number 34

squadron/signal publications

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Messerschmitt Bf 109E

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Color by Don Greer

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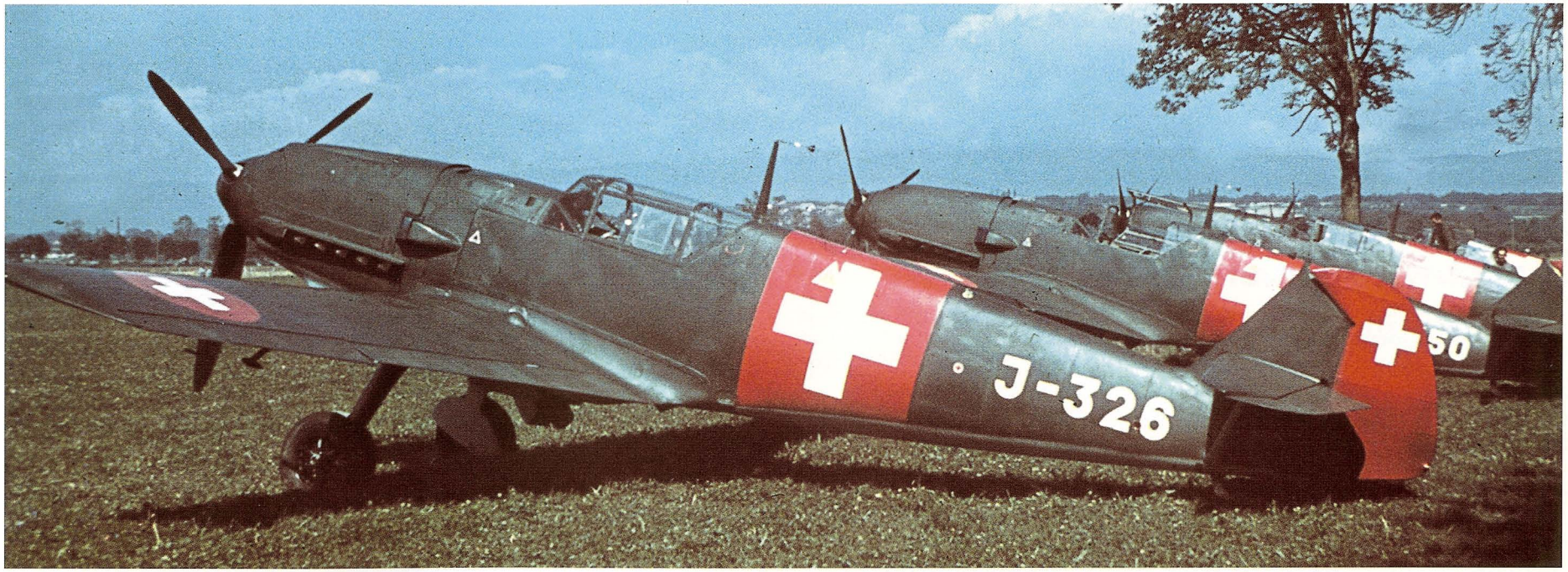

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Introduction

The Messerschmitt **Bf 109E** was the backbone of the Luftwaffe fighter force during the *Blitzkrieg* (Lightning War) campaigns between 1939 and 1941. This type saw combat in Spain with the *Legion Condor* during the Spanish Civil War, participated in the invasion of Poland in the Fall of 1939, and was successful over the French skies in the 1940 Western Europe campaign. During the Battle of Britain in the summer of 1940, the *Emil* (E in the German phonetic alphabet) clashed with the Supermarine Spitfire – the first enemy opponent that was equal or superior in performance. The Bf 109E also saw service in North Africa and the Balkans and participated in Operation BARBAROSSA, the German attack against the Soviet Union in June of 1941. Bf 109Es served in the fighter-bomber role on the Eastern Front until early 1944. The few surviving *Emils* assigned to training units served well into late 1944.

The *Emil* was the first Bf 109 variant powered by the DB 601A powerplant developed by Daimler-Benz AG at Stuttgart-Untertürkheim in Southern Germany. The DB 601A inverted 12-cylinder, liquid-cooled, inline engine had a take off rating of 1175 HP.

The first ten pre-series **Bf 109E-0** aircraft were manufactured at the Messerschmitt plant at Augsburg in Bavaria. These aircraft made their initial flights during the second half of 1938. The first two production **Bf 109E-1**s (*Werk Nummern*/Factory Numbers 1791 and 1792) were manufactured at Augsburg, while the other 12 *Emils* of the initial production batch were manufactured at other sub contractors. The Bf 109E-1 was armed by four 7.92MM Rheinmetall-Borsig MG 17 machine guns: two mounted in the upper fuselage and one in each wing. The **Bf 109E-1/B** *Jagdbomber* (Fighter-Bomber) carried one 500 KG (1102 pound) bomb, one 250

Dedication:

This book is respectfully dedicated to Bavaria, the most beautiful part of Germany. Only in Bavaria are hungry tourists served with plenty of food like *Knödel* (dumplings) and *Eisbein* (pig's knuckles) on huge plates with a never-ending flow of beer. Paradise on earth has a name – Bavaria.

Acknowledgements

A number of fellow friends and organizations contributed to this Walk Around. My special thanks to Andrea Lareida and Roland Küng of the Swiss Air Force Museum at Dübendorf, Switzerland for assisting me on matters with the Messerschmitt Bf 109E-3 on exhibit there. Walter Hodel took many detail pictures that I was unable to take.

I express my sincere thanks to a number of people who assisted me in writing this volume:

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Author's Note: Federal Standard (FS) color numbers were developed after World War Two and their use here is solely an approximation.

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(Front Cover) *Hauptmann* (Captain) Joachim Münchenberg's Bf 109E-7 (White 12) shoots down a Yugoslav Bf 109E-3 (L-26) on 6 April 1941. The German fighter was assigned to 7 *Staffel* (Squadron) of JG 26 (*Jagdgeschwader*; Fighter Wing) '*Schlageter*' during the German invasion of Yugoslavia (Operation MARITA).

(Previous Page) Switzerland was the first and the largest Bf 109E-3 export customer, receiving 80 aircraft in 1939 and 1940. The near Bf 109E-3 (J-326; *Werk Nummer*/Factory Number 2174) was assigned to the *Schweizer Fliegertruppe* (Swiss Air Force) between 27 June 1939 and 28 December 1948. The Germans delivered the adjoining Bf 109E-3 (J-350; *Werk Nummer* 2407) on 26 October 1939. This Messerschmitt was written off in an emergency landing on 1 October 1946 after 365 flying hours. (Swiss Air Force Museum via Roland Küng)

(Back Cover) *Major* Adolf Galland climbs out of his Bf 109E-4/N (*Werk Nummer* 5819) in France in mid-1940. Galland commanded III. *Gruppe* (Group) of JG 26 during the Battle of Britain.

The Bf 109E was the most important German fighter in the *Blitzkrieg* (Lightning War) campaigns in Poland and the West. The *Emil* also saw action during the Battle of Britain, over the Balkans, and as a fighter-bomber over the Soviet Union. This Regensburg-built Bf 109E-4 (*Werk Nummer* 1785) belongs to the *Stab* (Staff) of JG 27 (*Jagdgeschwader*; Fighter Wing), whose insignia is painted on the forward fuselage. The Black and White *Geschwader Adjutant* (Wing Second-in-Command) marking painted on the engine cowling usually appeared on the mid-fuselage. (ECPA)

KG (551 pound) bomb, or four 50 KG (110 pound) bombs on a fuselage mounted bomb rack. In August of 1940, most of the remaining Bf 109E-1s were upgraded to either E-3, E-4, or E-7 standard. The Bf 109E-1 was manufactured at Messerschmitt AG's Regensburg plant, Arado Flugzeugwerke GmbH at Warnemünde, Gerhard Fieseler Werke GmbH at Kassel-Bettenhausen, and *Aktien Gesellschaft Otto* (AGO) at Oschersleben. AGO was a subsidiary of the conglomerate *Allgemeine Elektricitäts-Gesellschaft* (AEG). The four factories combined to produce approximately 1183 Bf 109E-1s. Germany delivered three Bf 109E-1s to the *Vzdusne zbrane* (Vz; Slovak Air Arm) in July of 1942

Jagdgeschwader 54 (JG 54; Fighter Wing) was the first Luftwaffe unit to receive the Messerschmitt **Bf 109E-3** in the fall of 1939. Two 20MM MG FF cannon replaced the wing-mounted MG 17 machine guns. This cannon was developed by the Swiss company Werkzeugmaschinenfabrik Oerlikon at Zurich and built under license by Rheinmetall-Borsig. Installation of this cannon and the T-60 FF 60-round ammunition drum required a large blister on the lower wing surface. While the entire wing mounted MG 17s were enclosed within the wing, the Oerlikon weapon's barrels protruded from the leading edge. The fuselage structure was also strengthened. The Bf 109E-3 became by far the most produced *Emil* variant, with approximately 1246 aircraft built by six plants. *Wiener Neustädter Flugzeugwerke* (WNF) at Wiener Neustadt, Austria and Erla Maschinenwerk GmbH at Leipzig-Heiterblick, Saxony, Germany joined the four factories that produced the earlier Bf 109E-1 on E-3 production. The Bf 109E-3 was the first variant of this Messerschmitt fighter to be exported. Switzerland became the first and largest customer, with 80 aircraft delivered in 1939 and 1940. Other Bf 109E-3s were sent to Romania, Slovakia, the Soviet Union, Spain, and Yugoslavia.

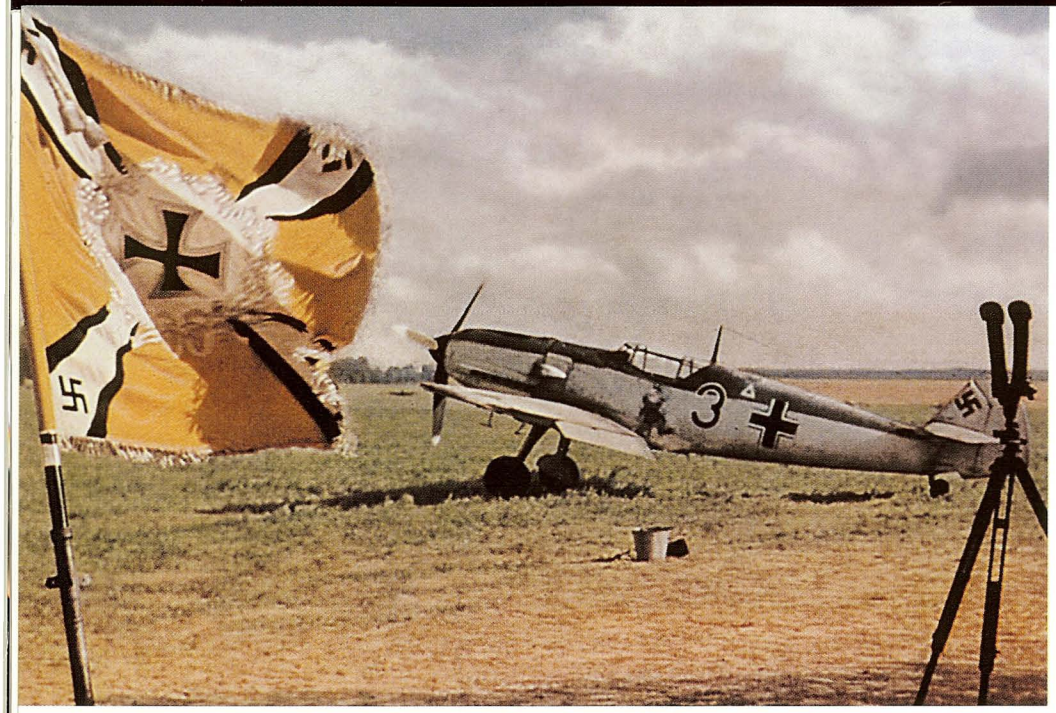
The **Bf 109E-4** followed the E-3 version into production in late 1940. This new variant included a redesigned canopy with heavier framing, which was simpler to produce. An 8MM armor plate was added to the canopy aft of the pilot's seat for head and shoulder protection. This modification was introduced based on lessons from the Polish and French campaigns. Several Bf 109E-1s and E-3s were retrofitted with the cockpit section armor plate. The improved performance 20MM MG FF/M cannon replaced the similar MG FF on the E-4. Approximately 496 Bf 109E-4s were built, not including earlier aircraft retrofitted to this standard. The Germans allocated 15 Bf 109E-4s to the Vz (Slovak Air Arm), where they served until 1944. A few Bf 109E-4s were delivered to the *Aeronautica Regalã Românã* (ARR; Royal Romanian Air Force) and the *Vazdushni Voyski* (VV; Royal Bulgarian Air Force). Germany shipped 12 Bf 109E-4s to Japan between 1940 and 1941.

The **Bf 109E-5** was a short-range reconnaissance version and the 29 examples built deleted the two wing cannon and had a Carl Zeiss Rb 21/18 camera with 300 exposures of film mounted in the rear fuselage. The nine **Bf 109E-6s** were makeshift reconnaissance aircraft based on the Bf 109E-3. The E-6 was equipped with a 1275 HP DB 601N engine, four 7.92MM MG 17 machine guns (two in the fuselage and one in each wing), and an Rb 12,5/7 hand-held camera.

The **Bf 109E-7** sub-variant was identical to the E-4, with the added capability for either a 300 L (79 gallon) fuel drop tank or bombs on an ETC 50 or ETC 500 bomb rack. Its spinner usually had a pointed tip instead of having the MG FF cannon aperture on earlier variants. The Bf 109E-7 was equipped with three oxygen bottles instead of only two as on previous versions. The ARR, VV, and the Vz were the sole export customers for the Bf 109E-7. The **Bf 109E-7/N** had an additional oxygen bottle and other equipment for high-altitude operations. The Bf 109E-7/Z was powered by a DB 601N with a GM-1 '*Mona*' booster system. This system increased engine power by approximately 280 HP at altitudes exceeding 8000 M (26,247 feet), which resulted in approximately 100 KMH (62 MPH) greater speed. Approximately 1735 Bf 109E-7s were either built or converted from earlier E-1s and E-3s.

Approximately 60 Bf 109E-1s were converted to **Bf 109E-8s**, with a 300 L drop tank. The **Bf 109E-9** was a long-range, high-altitude reconnaissance version developed from the Bf 109E-7. This variant had a Carl Zeiss Rb 50/30 camera with film for 380 exposures. The Bf 109E-9 became the last *Emil* sub-variant built.

Approximately 4722 Bf 109Es were built between 1938 and March 1941. (Exact production totals are unknown, since their records were destroyed during the war.) The Luftwaffe accepted the last *Emil* into service in June of 1941. They remained in fighter-bomber service on the Eastern Front through the fall of 1944. Many surviving *Emils* were assigned to pilot schools, where they served well into the late stages of Germany's collapse and defeat in May of 1945.

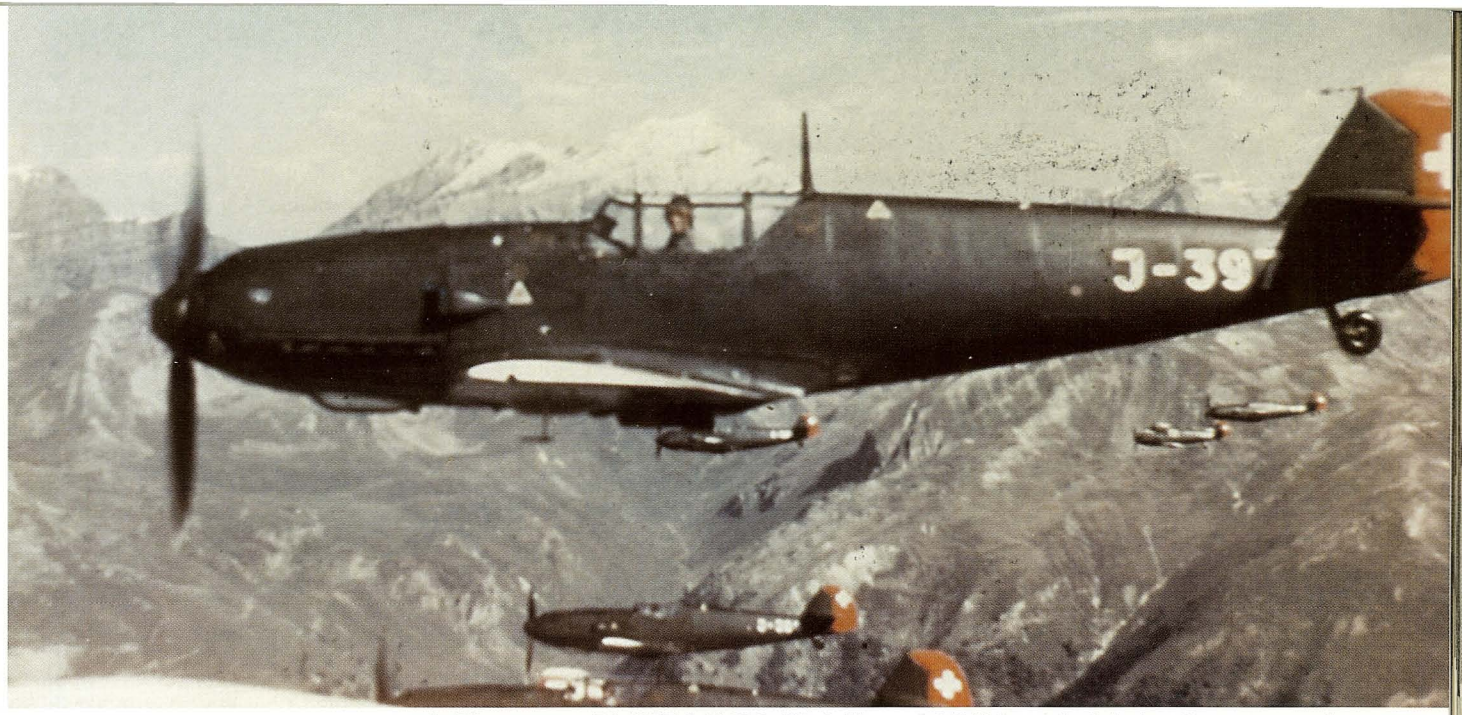


A Bf 109E-3 (Black 3) rests on an airstrip in France during the Battle of Britain in the summer of 1940. This *Emil* is painted in the standard Luftwaffe fighter camouflage of RLM 70 *Schwarzgrün* (Black Green; FS34050) and RLM 71 *Dunkelgrün* (Dark Green; FS34079) above RLM 65 *Hellblau* (Light Blue; FS35352). The height of the upper and lower color demarcation line was typical for a III. *Gruppe* (3rd Group) JG 26 *Emil*. Flags of Luftwaffe flying units were predominantly Golden Yellow, which was the arm-of-service color for such units. A spotting periscope stands in the foreground. (MBB)

(Above) This *Aeronautica Regalã Românã* (ARR; Royal Romanian Air Force) Bf 109E-3 (64; *Werk Nummer* 704) had an additional 8MM armor plate fitted in the rear canopy frame. This additional armor was installed as a frontline modification. Most ARR *Emils* were former Luftwaffe aircraft refurbished by the Amme Luther Seck Company before delivery to Romania. This Bf 109E-3 was assigned to *Grupul 7 vânãtoare* (7th Fighter Group). *Nella* is painted in White on the engine cowling. The Michael's Cross national insignia was introduced on all ARR aircraft in mid-May of 1941. This consisted of four white-bordered blue 'Ms' arranged in a cross pattern and filled with Yellow. A roundel in (from center) Blue, Yellow, and Red was located in the center. The 'M' stood for *Mihai* (Michael), the King of Romania. RLM 04 *Gelb* (Yellow; FS33538) engine cowlings, wingtips, and rear fuselage bands identified Axis aircraft operating on the Eastern Front. Donald Duck – this Group's unofficial insignia – is painted on the rear fuselage. This Bf 109E-3 was flown to the IAR (*Industria Aeronauticã Românã*; Romanian Aeronautical Industry) factory at Brasov (Kronstadt) for repairs in July of 1942. It later participated in the battle of Stalingrad (now Volgograd) in 1942-43. The tail of the sole IAR-47 reconnaissance aircraft prototype built at Brasov appears in the background. (Dan Antoniu)

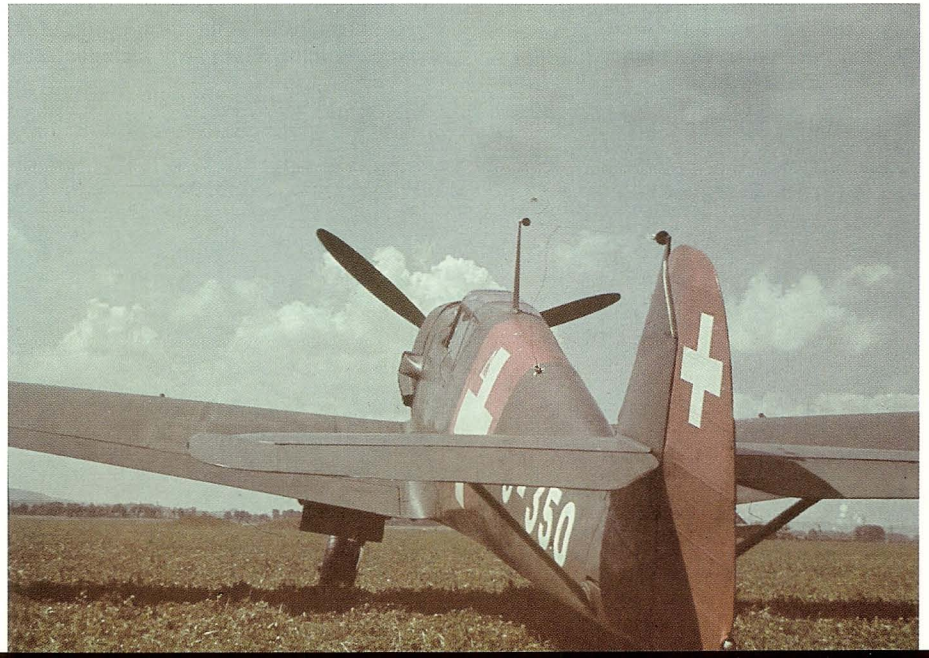
(Left) *Oberleutnant* (1st Lieutenant) Werner Schroer flies his Bf 109E-7/*Trop* (Black 8) over the Libyan coast in April of 1941. This particular *Emil* belonged to I. *Gruppe* of JG 27. The Wing's emblem was painted on the engine cowling. This Bf 109E-7/*Trop* is finished in the Luftwaffe's North African camouflage of RLM 79 *Sandgelb* (Sand Yellow; FS30215) and RLM 80 *Olivgrün* (Olive Green; FS34052) over RLM 78 *Hellblau* (Light Blue; FS35414). A tropical sand filter was mounted in front of the supercharger air intake. The RLM 21 *Weiss* (White; FS37886) aft fuselage band appeared on Axis aircraft operating over the Mediterranean and North Africa. (MBB)

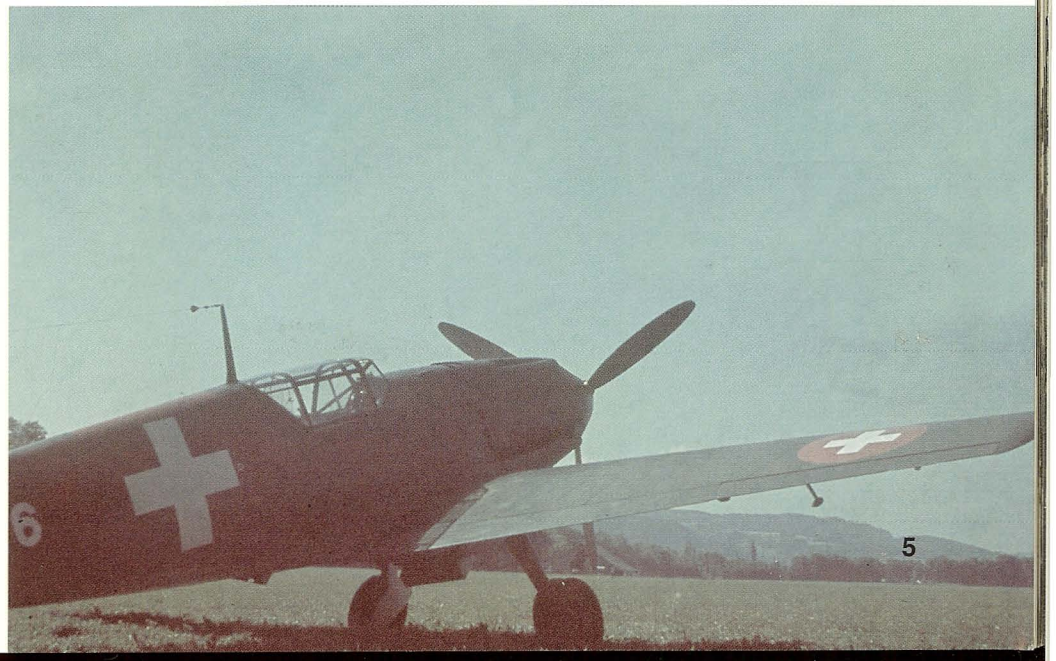
A formation of Bf 109E-3s assigned to *Flieger Staffel* 8 (8th Flying Squadron) cruise over the Alps. It is believed that this photograph was taken on the last flight of an *Emil* in Swiss Air Force operational service in 1949. Switzerland's air force was called the *Fliegertruppe* before 1946, when it was renamed the *Flugwaffe*. The near Bf 109E-3 (J-397) was built by Doflug at Altenrhein, Switzerland from spare parts found in *Fliegertruppe* arsenals after the end of World War Two. The Swiss did not assign *Werk Nummern* (Factory Numbers) to the *Emils* they assembled from spare parts. The *Fliegertruppe* accepted this particular Bf 109E-3 on 7 December 1945. The Red and White neutrality stripes were painted only on the wings. These stripes and the national insignia were removed from the rear fuselage after the conflict. J-397 was withdrawn from service on 28 December 1949. (Max Brenneisen via Roland Küng)

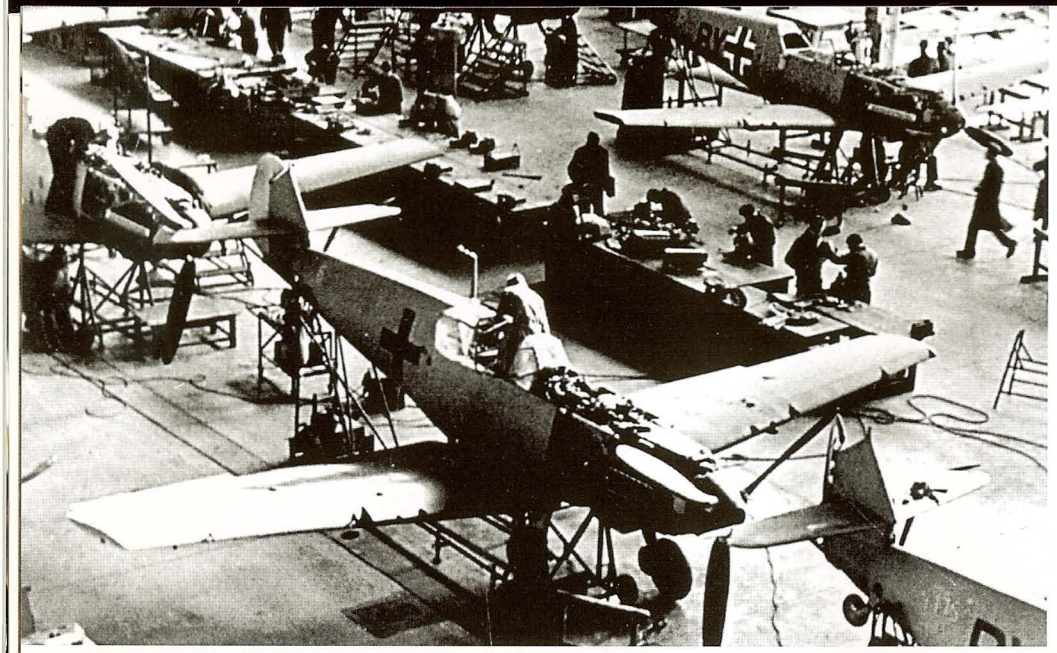


A *Fliegertruppe* Bf 109E-3 (J-326; *Werk Nummer* 2174) is parked during the summer of 1940. The Swiss accepted this *Emil* from Germany on 27 June 1939. It was in a two tone green upper surface camouflage of RLM 70 Black Green and RLM 71 Dark Green. This original German camouflage was soon replaced by the Swiss KW 2 color, which was similar to RLM 70. The White cross was painted on a Red disc on the wing upper surfaces, while this same cross was placed on a Red square on the fuselage sides and wing undersurfaces. The *Fliegertruppe* removed J-326 from service on 28 December 1948. (Swiss Air Force Museum via Roland Küng)

This Bf 109E-3 (J-350; *Werk Nummer* 2407) belonged to the second series of *Emils* Messerschmitt built at its Regensburg plant for the Swiss Air Force. These Bf 109E-3 were delivered with RLM 70 Black Green upper surfaces and RLM 65 Light Blue undersurfaces. The *Fliegertruppe* accepted J-350 on 26 October 1939. It was photographed during exercises in Western Switzerland in the summer of 1940. (Swiss Air Force Museum via Roland Küng)







Bf 109E-1s are assembled at the Messerschmitt plant at Regensburg, Bavaria, Germany. No camouflage was applied, but the *Balkenkreuz* (Beam Cross) national insignia and the first two letters of the four-letter *Stammkennzeichen* (Root Markings) code were sprayed on the fuselage of many aircraft. (MBB)

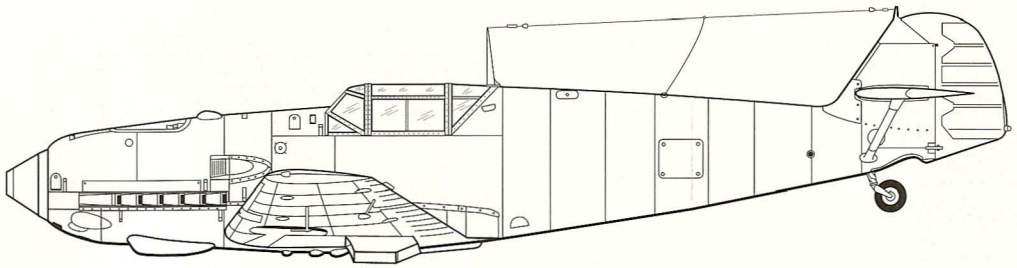
A mechanic overhauls a Bf 109E-1 of an unknown wing's 5. *Staffel*, II. *Gruppe* (2nd Group). A White-outlined RLM 23 *Rot* (Red; FS31140) horizontal bar is painted aft of the fuselage *Balkenkreuz*. This *Emil* was painted with RLM 70 Black Green upper surfaces and RLM 65 Light Blue undersurfaces. The Luftwaffe employed this style of *Balkenkreuz*, with narrow White outlines on upper and lower wing surfaces until late September of 1939. (Manfred Griehl)

Several *Legion Condor* Bf 109E-3s, including 6•112 (front) and 6•121, are parked late in the Spanish Civil War in early 1939. The *Zylinderhut* (top hat) insignia denoted 2. *Staffel* (Squadron) of the *Legion*'s J/88 (*Jagdgruppe*; Fighter Group). This *Emil*'s scheme consisted of RLM 62 *Grün* (Green; FS36165) upper surfaces and RLM 65 Light Blue undersurfaces. The wing tips and rudder are White, the latter with a Black diagonal cross. The Black lower fuselage trim for covering exhaust stains was typical for *Emils* deployed to Spain. (Harold Thiele)

This Bf 109E-1 was assigned to a *Werkschutzstaffel* (Factory Protection Squadron) defending the Gerhard Fieseler Werke GmbH production plant at Kassel, Germany. Fieseler built the *Emil* under license from Messerschmitt AG. This unit remained in existence between 16 October 1939 and 7 August 1940. The Messerschmitt insignia was painted on the engine cowling, while the nearby R stood for this *Emil*'s pilot, Anton Riediger. He later became an acceptance pilot for the Luftwaffe, handing over newly manufactured Bf 109s. (Heinz Riediger)

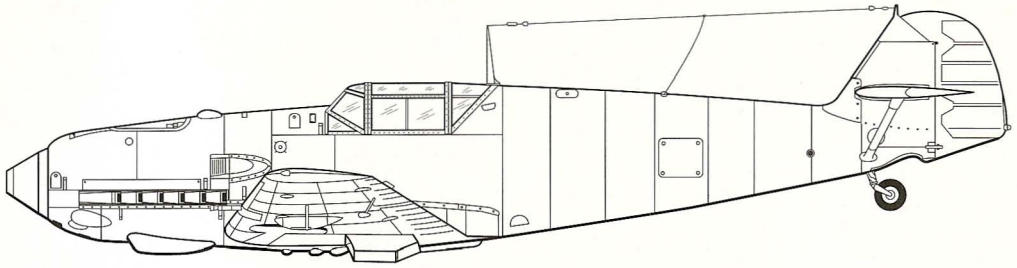
Messerschmitt Bf 109E-1

The Bf 109E-1 was the first large-scale production variant powered by the Daimler-Benz DB 601A engine. It was armed with two fuselage-mounted 7.92MM Rheinmetall-Borsig MG 17 machine guns in the fuselage and two wing-mounted MG 17s. The first two *Emils* left the assembly line in November of 1938. Many Bf 109E-1s were subsequently upgraded to the E-3 standard.



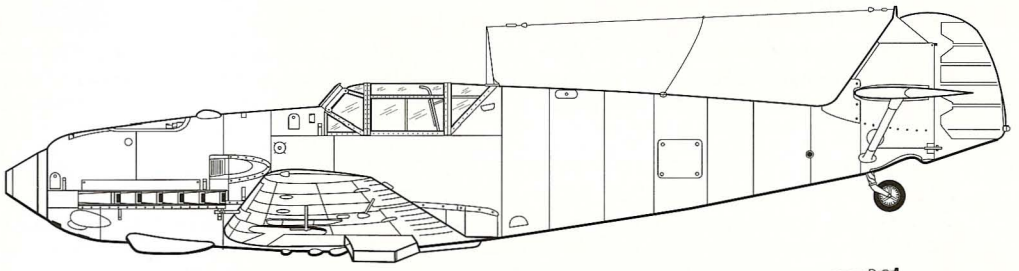
Messerschmitt Bf 109E-3 (Early)

The first Bf 109E-3 was delivered in the fall of 1939 and this became the most produced Emil sub-variant. The Swiss-developed, German-built Rheinmetall-Borsig 20MM MG FF cannon replaced the wing-mounted MG 17 machine guns. A blister placed on the lower wing surface accommodated the weapon and its 60-round *Trommel* T-60 FF ammunition drum.



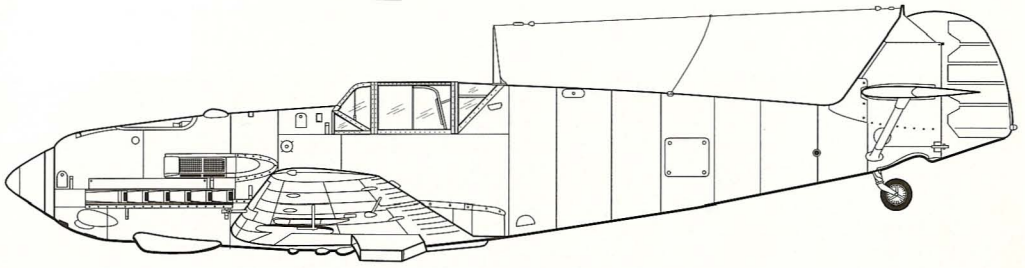
Messerschmitt Bf 109E-3 (Modified)

During its operational service, Bf 109E-3 canopy center sections were field modified with an 8MM armor plate mounted behind the pilot's seat. Some Bf 109E-3s also had a 58MM bulletproof windshield mounted in front of the standard windshield. These two modifications were performed by frontline modification centers, not on the production line.



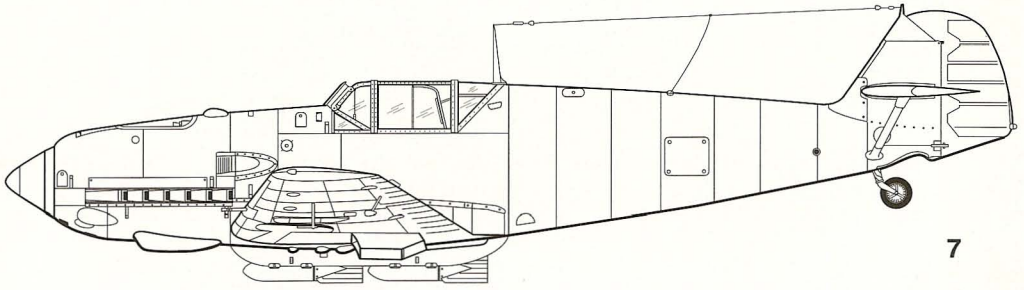
Messerschmitt Bf 109E-4/*Trop*

The Bf 109E-4 received a modified front canopy with heavier framing and an armor plate behind the cockpit seat on the production line. Two improved 20MM Rheinmetall-Borsig (Oerlikon) MG FF/M cannon were mounted in the wings, replacing the earlier MG FFs. Bf 109E-4s modified for the North African theater of operations were equipped with a sand filter on the supercharger intake. The first Bf 109E-4/*Trops* (*tropenbeständig*; tropicalized) were delivered to JG 27 in April of 1941.



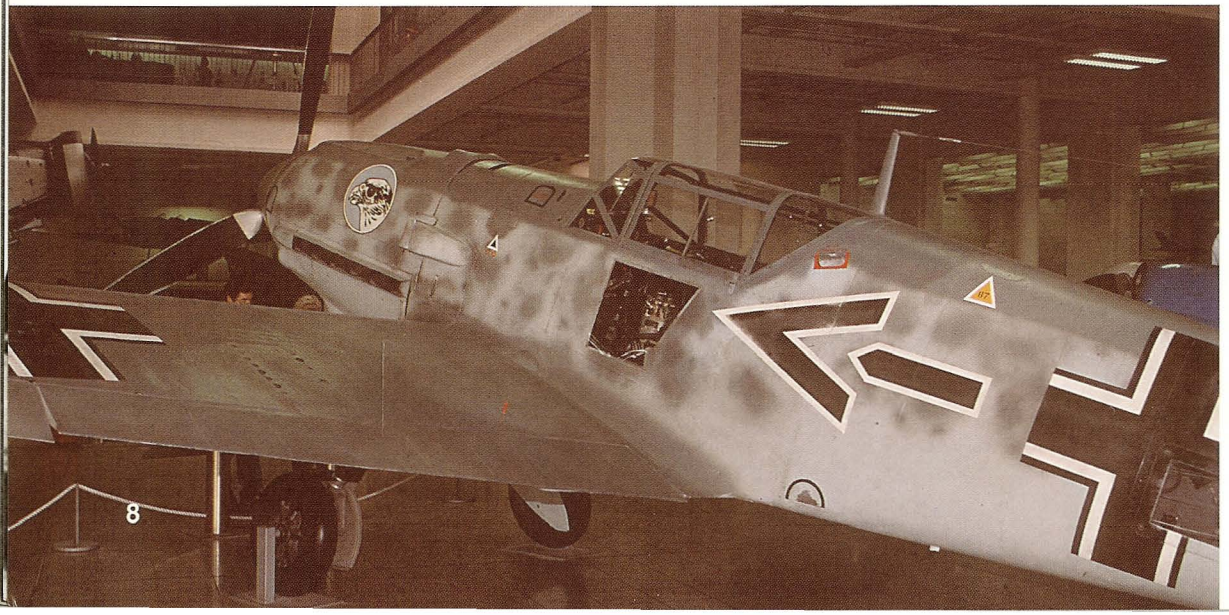
Messerschmitt Bf 109E-7/B

The Bf 109E-7's propeller spinner usually had a pointed tip rather than having the MG FF cannon aperture on earlier sub-variants. The Bf 109E-7/B was a fighter-bomber version, which had one ETC 50 or ETC 500 bomb rack mounted under the fuselage. This variant was also able to carry a 300 L (79 gallon) drop tank in place of ordnance.



This Bf 109E-3 (*Werk Nummer* 790) is displayed at the *Deutsches Museum* (German Museum) at Munich, Bavaria, Germany. It is the the oldest existing *Emil* on exhibit. Erla Maschinenwerk GmbH at Leipzig-Heiterblick, Saxony, Germany built this aircraft in early 1939 and it saw action in the Spanish Civil War. A clear plastic panel replaced a section of the port skin to reveal the cockpit interior. A Swiss Air Force Fieseler Fi 156 *Storch* (A-96; *Werk Nummer* 4299) – donated to the Museum in 1965 – hangs from the ceiling.

The *Deutsches Museum* loaned their Bf 109E-3 to JG 74 of the *Bundesluftwaffe* at Neuburg-Donau in November of 1973. This was for a ceremony in which this Wing received the traditional name *'Mölders.'* During this occasion, the former Spanish Air Force aircraft was painted to represent an *Emil* flown by *Major* Werner Mölders, *Kommodore* of JG 51 during the Battle of Britain in the summer of 1940.



Deutsches Museum Bf 109E-3

The Bf 109E-3 displayed at the *Deutsches Museum* (German Museum) at Munich, Bavaria, Germany is the oldest existing *Emil* on exhibit. This aircraft (*Werk Nummer*/Factory Number 790) was built at the Erla Maschinenwerk GmbH factory at Leipzig-Heiterblick in Saxony, Germany in early 1939. Erla Maschinenwerk GmbH was one of several companies that built the *Emil* under license from Messerschmitt AG.

The aircraft was shipped to Spain, where the *Emil* saw action with 2. *Staffel* (2nd Squadron) of J/88 (*Jagdgruppe*; Fighter Group), *Legion Condor*. (This German air-ground Legion supported Nationalist forces during the Spanish Civil War of 1936-39.) The code 6•106 was assigned to this particular Bf 109E-3. (This was the 106th Bf 109 – type code number 6 – in Nationalist service.) The Germans turned this Bf 109E-3 over to the *Ejército del Aire* (EdA; Spanish Air Force) at Leon Air Base after the Spanish Civil War ended on 29 March 1939. This *Emil* had only 25 flight hours at the time.

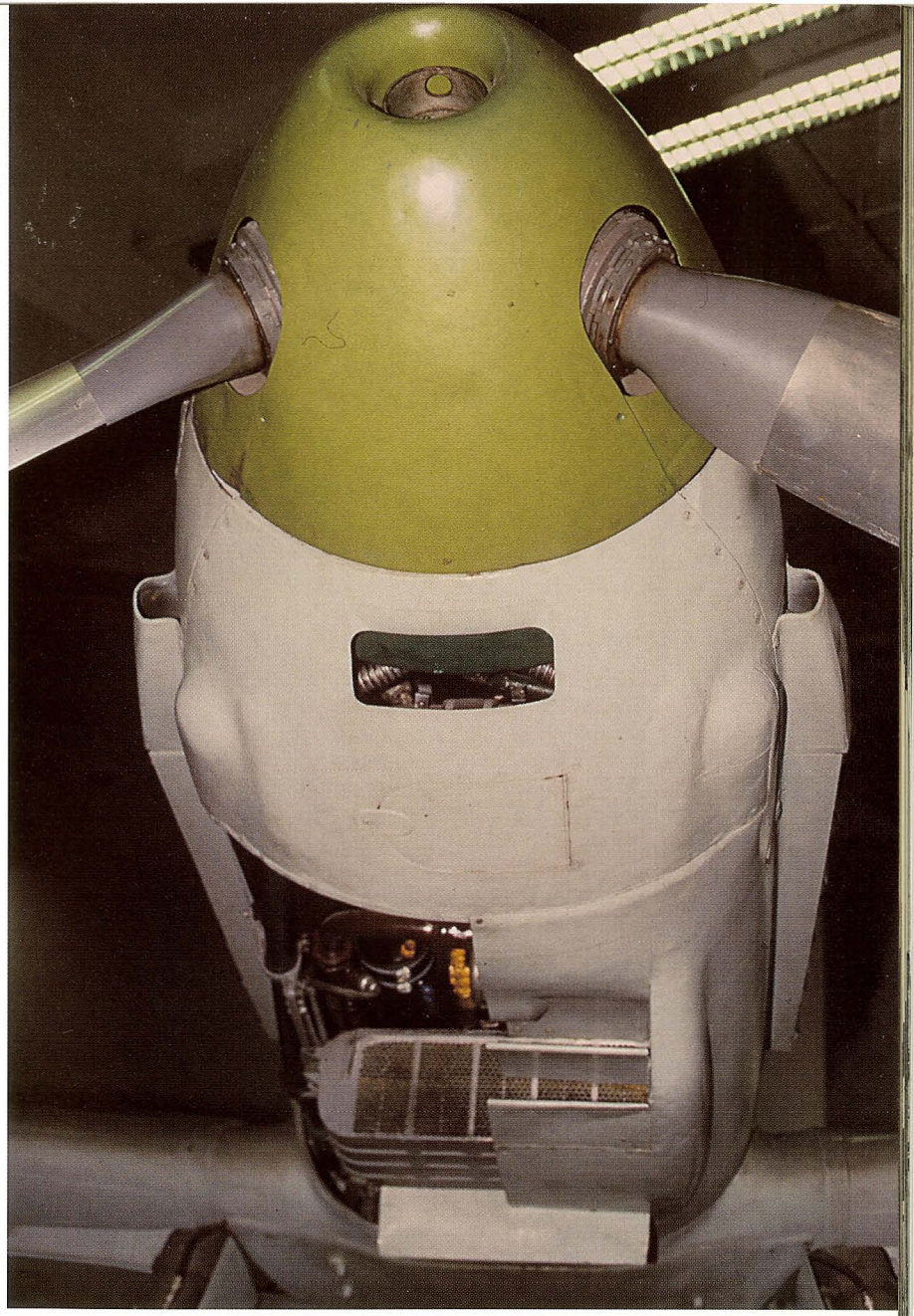
The EdA assigned the new serial number C.4E-106 to this Bf 109E-3. C.4E (*Caza*; Fighter) was the new Spanish designation for the Bf 109E. It served with several EdA Squadrons until it was damaged in a 'belly' (wheels-up) landing in 1946. This fighter was repaired, but did not fly again. It served as a ground instructional airframe at Logrogno Air Base until 1959. This Bf 109E-3 was the sole original Messerschmitt-built fighter in the *Ejército del Aire* inventory at the time.

The Spanish Air Ministry donated C.4E-106 to the *Deutsches Museum* in September of 1960. This was done on the request of Professor Willy Messerschmitt, the Bf 109's designer, who worked with Hispano Aviación SA in Sevilla, Spain after World War Two. (This firm built a modified Bf 109 as the HA 1109 fighter for the EdA between 1945 and 1958.) Hispano Aviación refurbished the Bf 109E-3 and painted it in the markings of JG 26 (*Jagdgeschwader*; Fighter Wing) *'Schlageter'* during the Battle of Britain in 1940. A *Hakenkreuz* (swastika) was painted on both sides of the vertical stabilizer, but this was overpainted and the *Stammkennzeichen* (ferry marking) AJ+YH applied before the aircraft was displayed in Germany.

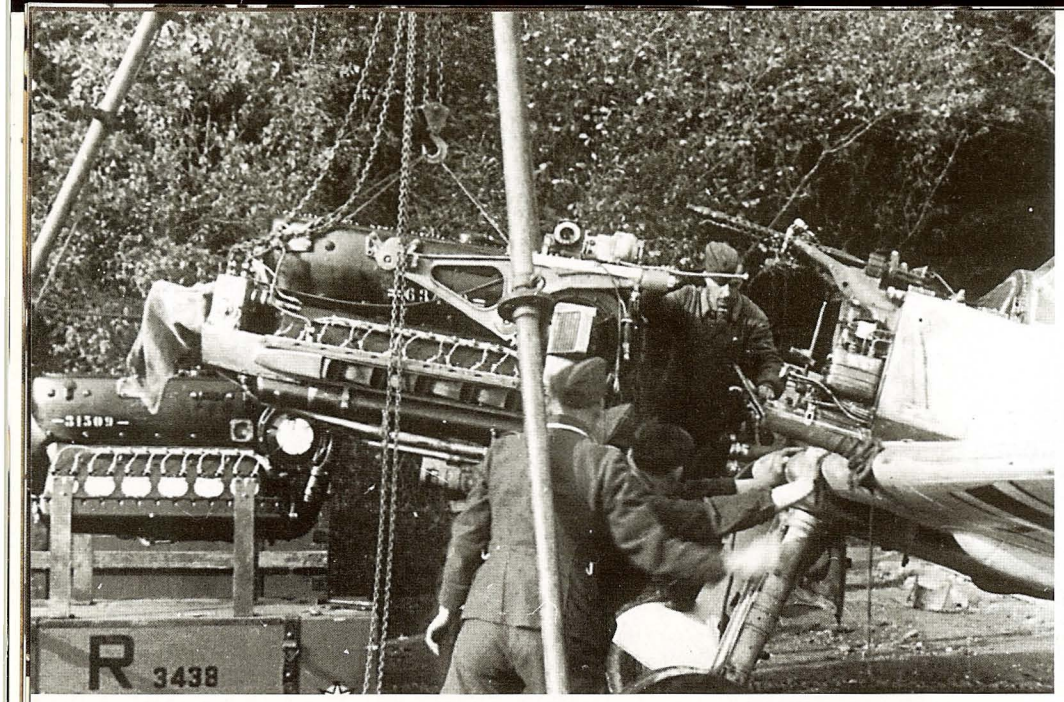
In November of 1973, JG 74 of the *Bundesluftwaffe* (Federal German Air Force) was christened *'Mölders,'* after the famous World War Two Bf 109 ace Werner Mölders. The *Deutsches Museum*'s Bf 109E-3 was loaned to the Wing – then equipped with Lockheed F-104G Starfighters – at Neuburg-Donau Air Base for the naming ceremony. It was painted in the markings of an *Emil Major* Mölders flew while *Kommodore* of JG 51 during the summer of 1940. The false *Werk Nummer* 2804 was also painted on the vertical tail. This Bf 109E-3 was returned to the *Deutsches Museum* after this ceremony and is now on permanent exhibit, still painted in the markings of Werner Mölders' aircraft.

The JG 51 insignia is painted on the engine cowling of the Bf 109E-3 displayed at Munich. This unit insignia was applied in November of 1973, when this particular aircraft was on loan to JG 74's home base at Neuburg-Donau. JG 74 flew the Lockheed F-104G Starfighter at that time; in 2004, they began transitioning from McDonnell Douglas F-4F Phantom IIs to Eurofighter Typhoons.

The Bf 109E-3's Daimler-Benz DB 601A inline engine turned a three-bladed VDM propeller. This all-metal, variable pitch propeller was 3.1 M (10 feet 2 inches) in diameter. The pilot electrically adjusted the blades' pitch through a two-way switch. This switch sent inputs to the pitch governor that changed each blade's pitch.

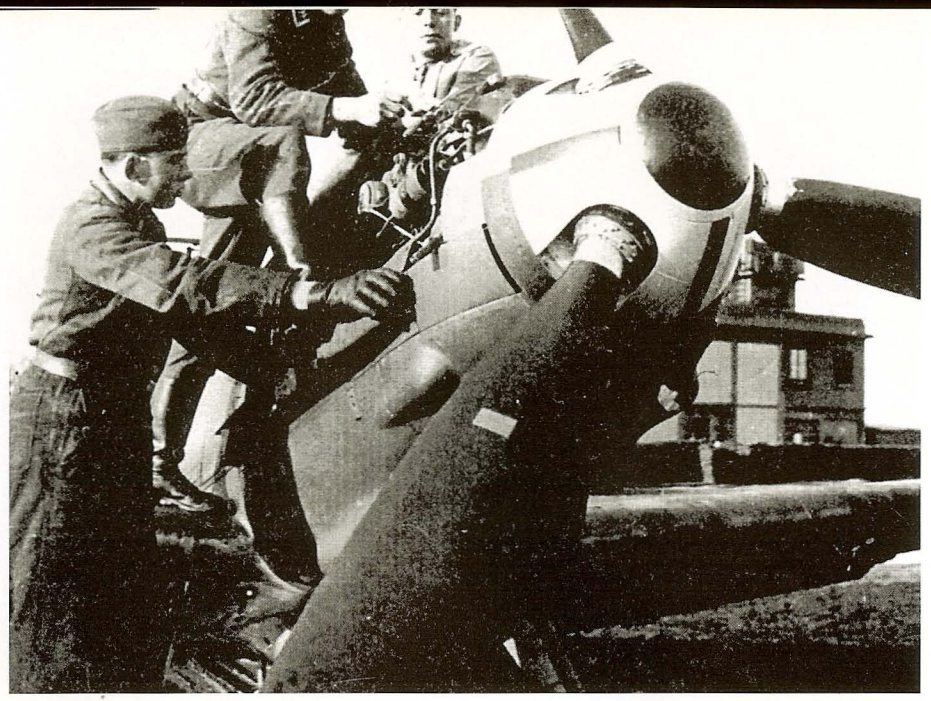


Oil is discharged through a rectangular opening on the nose undersurface, immediately aft of the propeller spinner. Two drop-shaped fairings for coolant piping flank the lower nose sides. The *Deutsches Museum* removed part of the radiator fairing to reveal its interior. The opened radiator exit flap is placed immediately aft of the radiator. Cooling air tunnels in front of the exhaust stacks were typical for the Daimler-Benz-powered Bf 109E-3.



Luftwaffe mechanics remove a Daimler-Benz DB 601A engine from a Bf 109E-7 at a front-line airfield. This 12-cylinder, liquid-cooled, inline engine was rated at 1100 HP at 2400 RPM. The DB 601A was a fuel-injected powerplant with a cubic volume of 33.9 L (2069 cubic inches) and a compression ratio of 6.9 to 1. It took between 2420 and 3000 man-hours to assemble one DB 601. (Hans Obert)

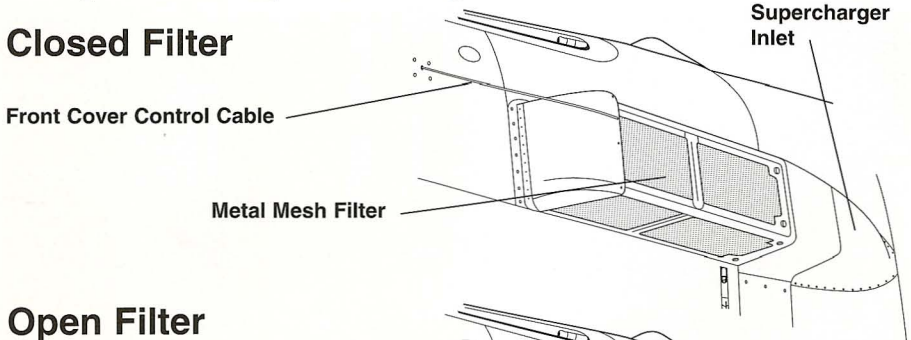
A *Obergefreiter* (Chief Corporal) applies RLM 04 Yellow paint to the nose of a 1./JG 27 Bf 109E-7/*Trop*. This *Emil* has the sand filter fitted over its supercharger intake. The filter's front is closed over the intake opening, while a fine metal mesh screen makes up the filter's sides. A control cable for opening and closing this filter runs from near the JG 27 insignia to immediately aft of the filter's cover. (*Bundesarchiv*)



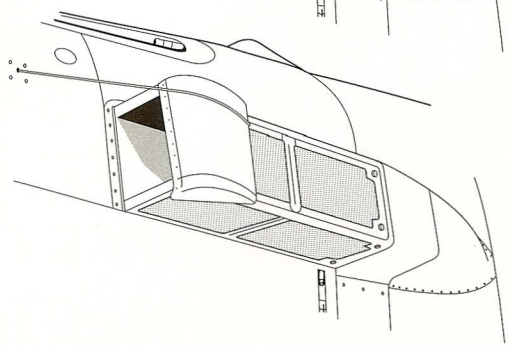
Luftwaffe mechanics perform an overhaul on a Bf 109E-7. This sub-variant introduced a more pointed spinner with a cup over the circular aperture found on spinners used by the Bf 109E-4 and earlier sub-variants. Daimler-Benz factories at Berlin-Marienfelde and Genshagen and subcontractors Büssing at Braunschweig and Henschel at Kassel-Altenbauna built 19,322 DB 601s between 1936 and 1942. Each DB 601 cost between 28,800 and 33,800 Reichsmarks. (*Bundesarchiv*)

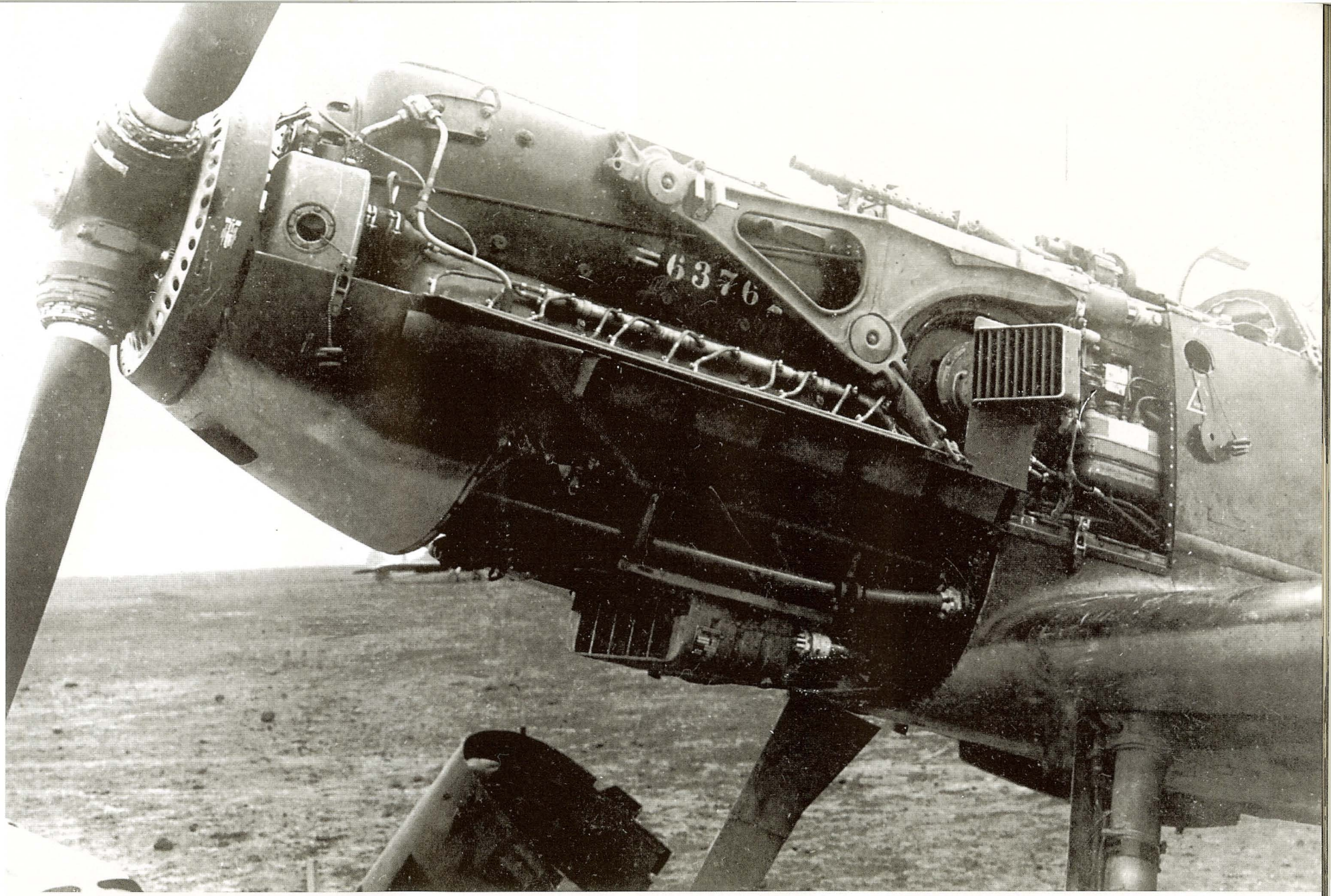
Tropical Supercharger Filter

Closed Filter



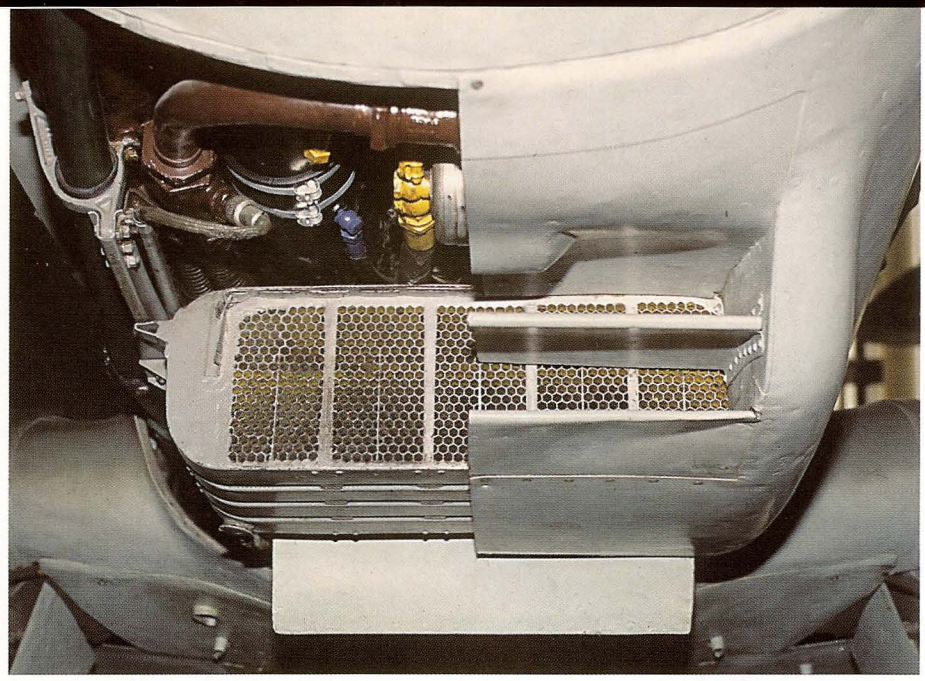
Open Filter





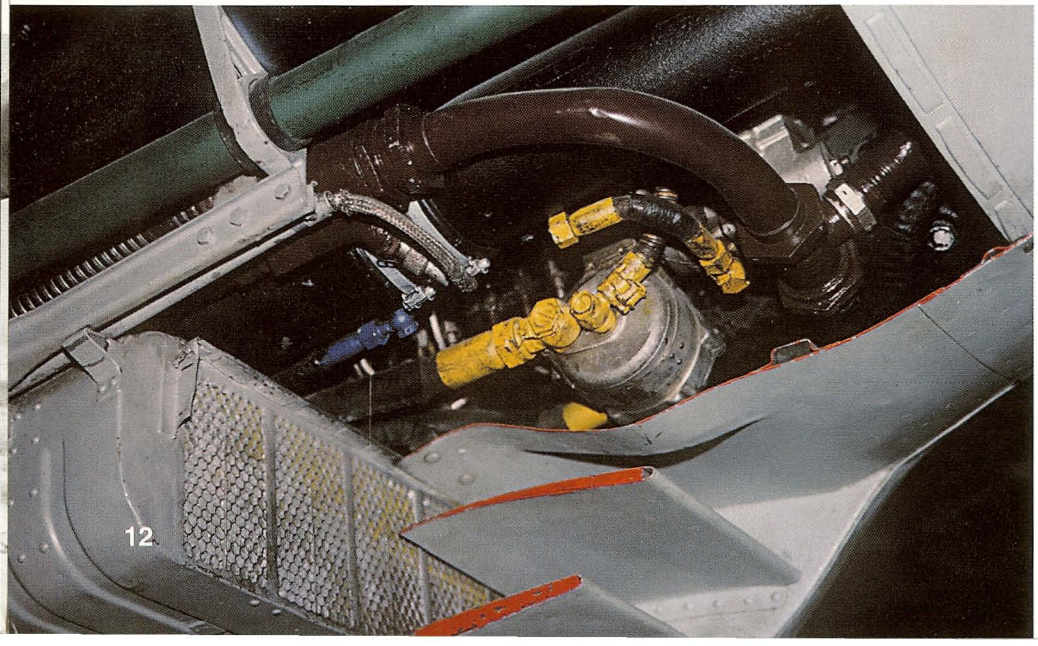
This *Emil* is one of five Bf 109E-3s Germany sold to the Soviet Union in May of 1940. The sale was made possible by the 1939 German-Soviet Non-Aggression Treaty. Engine cowling panels were removed from the aircraft, revealing the Daimler-Benz DB 601A engine. Fuel is injected into each of the 12 cylinders by a Bosch PZ 12 HM pump. This pump was suspended from the crankcase between the cylinder banks and was provided with an automatic mixture control. A Bosch dual ZM 12 BR 4 magneto was mounted atop the drive case and fired two Bosch DW 240 ET 8 spark plugs per cylinder. The serial number 63762 is painted on the crankcase in either White or Yellow. A device on this engine cleaned oil off spark plugs during engine operation. (Viktor Kulikov)

The cutaway lower cowl on the *Deutsches Museum*'s Bf 109E-3 reveals the lower engine compartment. Coolant – a mixture of water and glycol – was pumped using the silver Daimler-Benz pump ahead of the radiator. Coolant passed from the jackets by two outlet elbows to the U-shaped header tank around the reduction gear casing. It then passed through swirl chambers in the tanks' air spaces, which released any vapor. Finally, the coolant moved through internal pipes to the tank outlets, where it passed to the radiator.

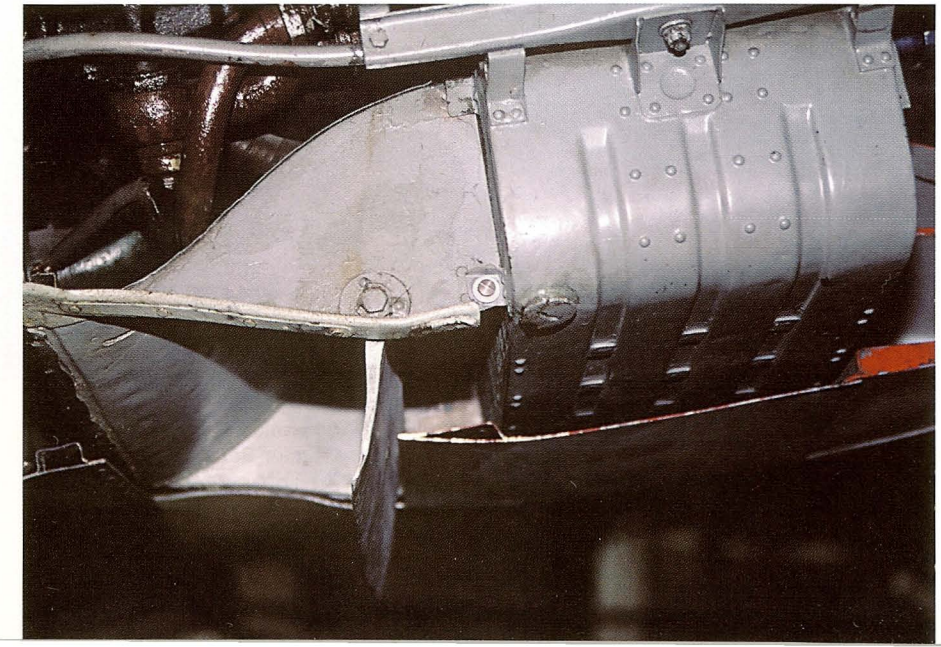


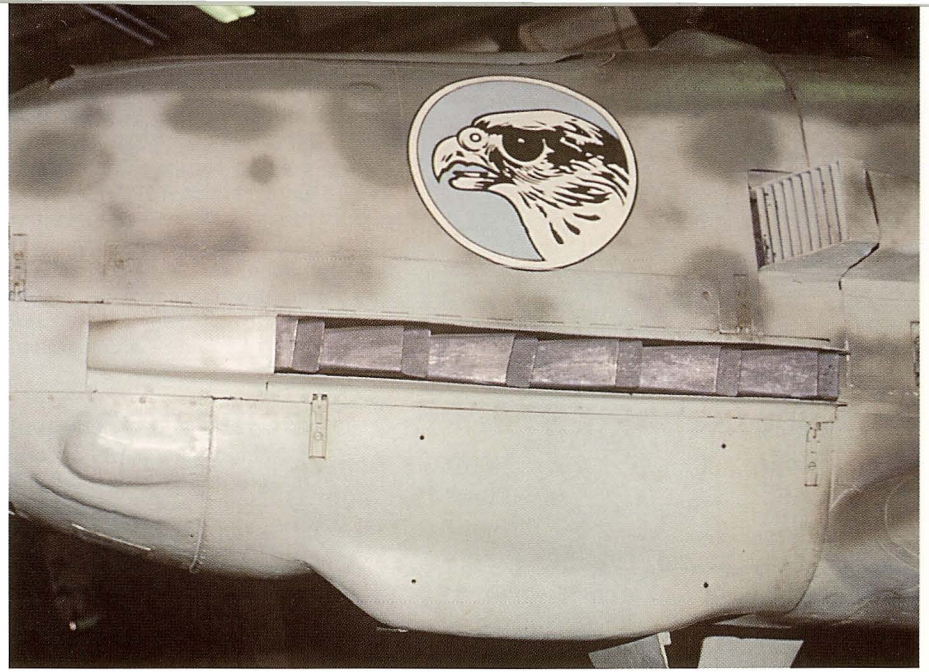
The DB 601A's oil radiator was mounted on the undersurface, whose starboard skin was removed for exhibit. Oil temperatures in this radiator varied between 40° and 95° Celsius (104° and 203° Fahrenheit).

Lubricant and water pipes were tightly mounted around both the Daimler-Benz engine and the coolant pumps. Mechanics mixed water with glycol – designated Shell anti-corrosion oil type number 39 by the Germans – for the DB 601A.

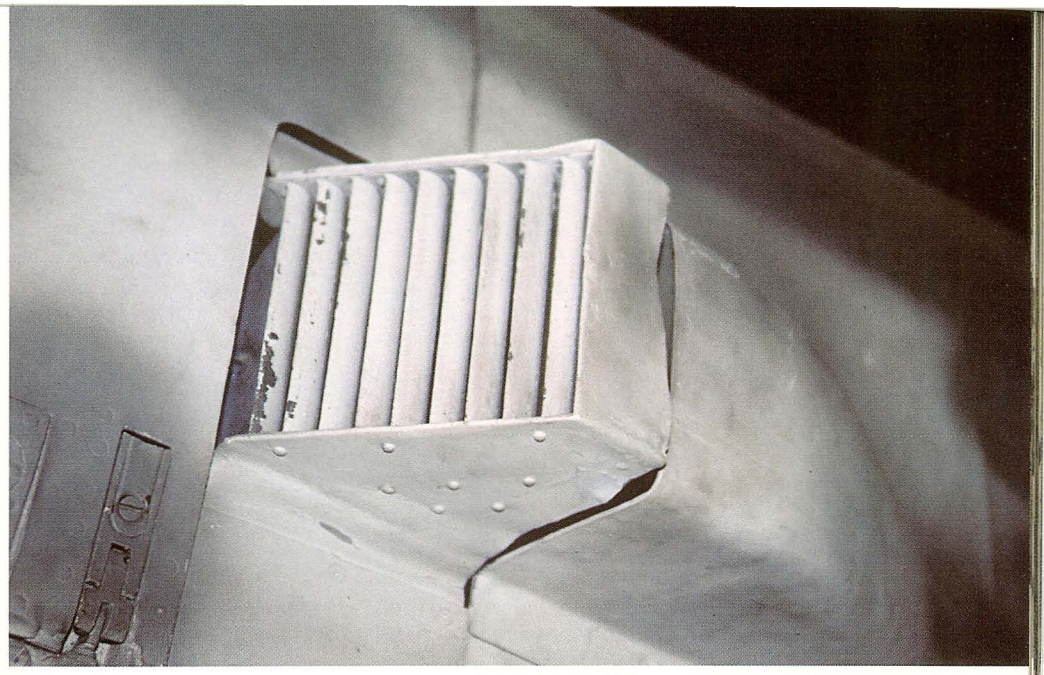


The radiator outlet flap is fully extended from the rear of the oil cooler compartment. Hot air vented from the radiator through this section. The pilot adjusted this flap to regulate the amount of heated air coming out of the radiator.





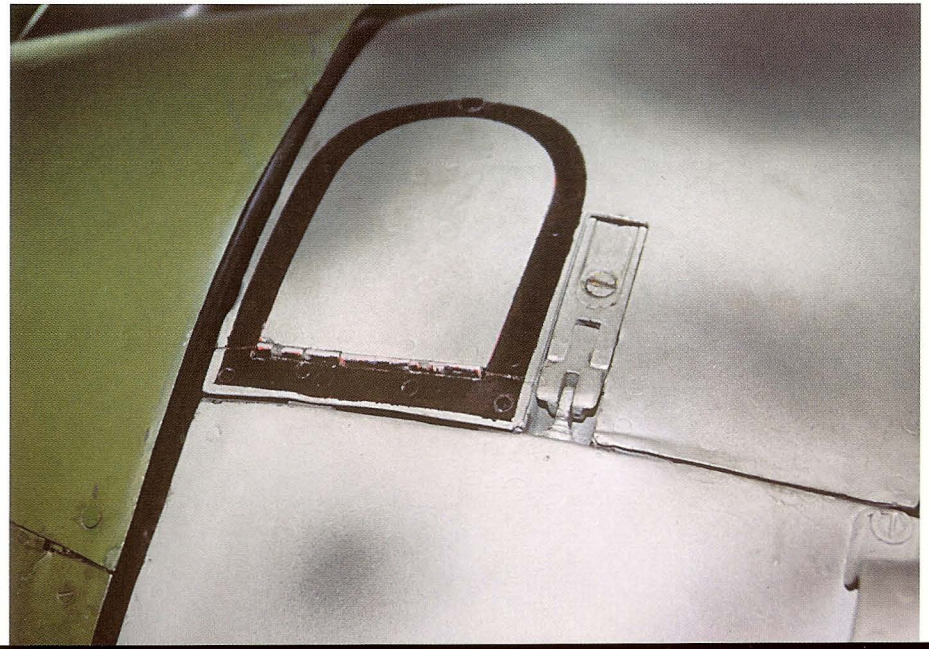
Several access hatches were mounted in the Bf 109E-3's cowling. Flush mounted snap latches allowed for easy cowling removal for engine maintenance. The supercharger air intake was only located on the port side.

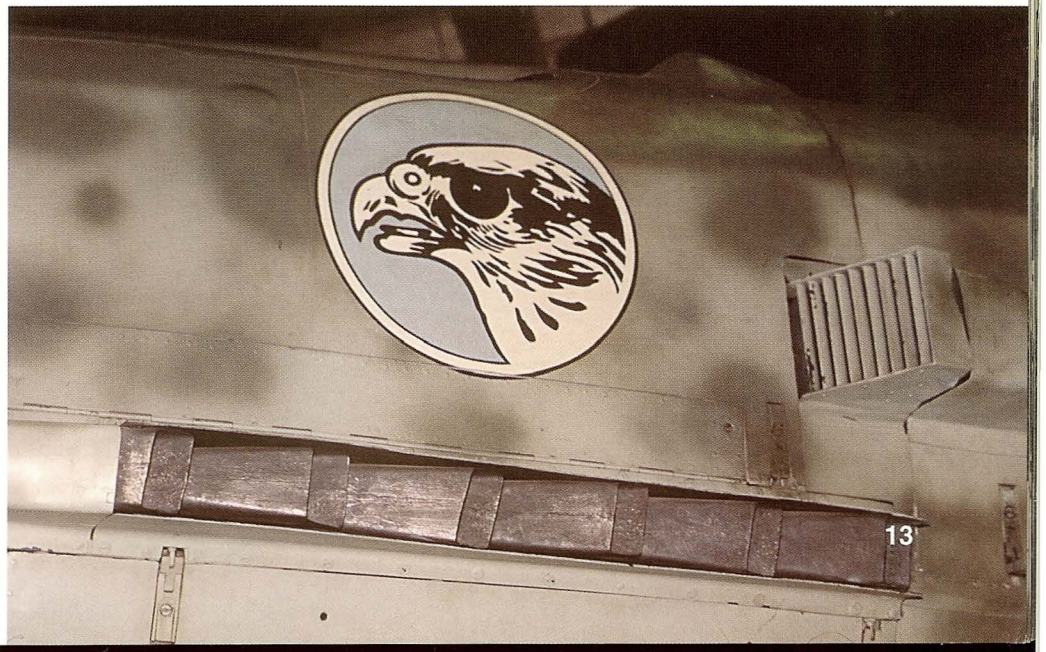


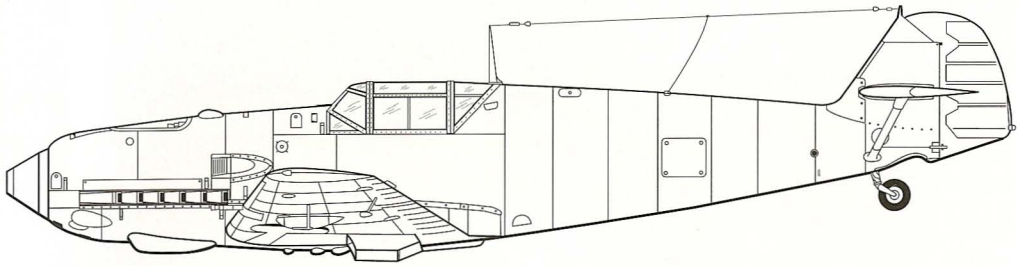
The Bf 109E (*Emil*) had this unique supercharger air intake design. This intake was aerodynamically refined on the subsequent Bf 109F (*Friedrich*) and Bf 109G (*Gustav*) variants. Air passed through this intake to the single stage supercharger, which had a die-forged duralumin half-shrouded impeller with straight radial blades.

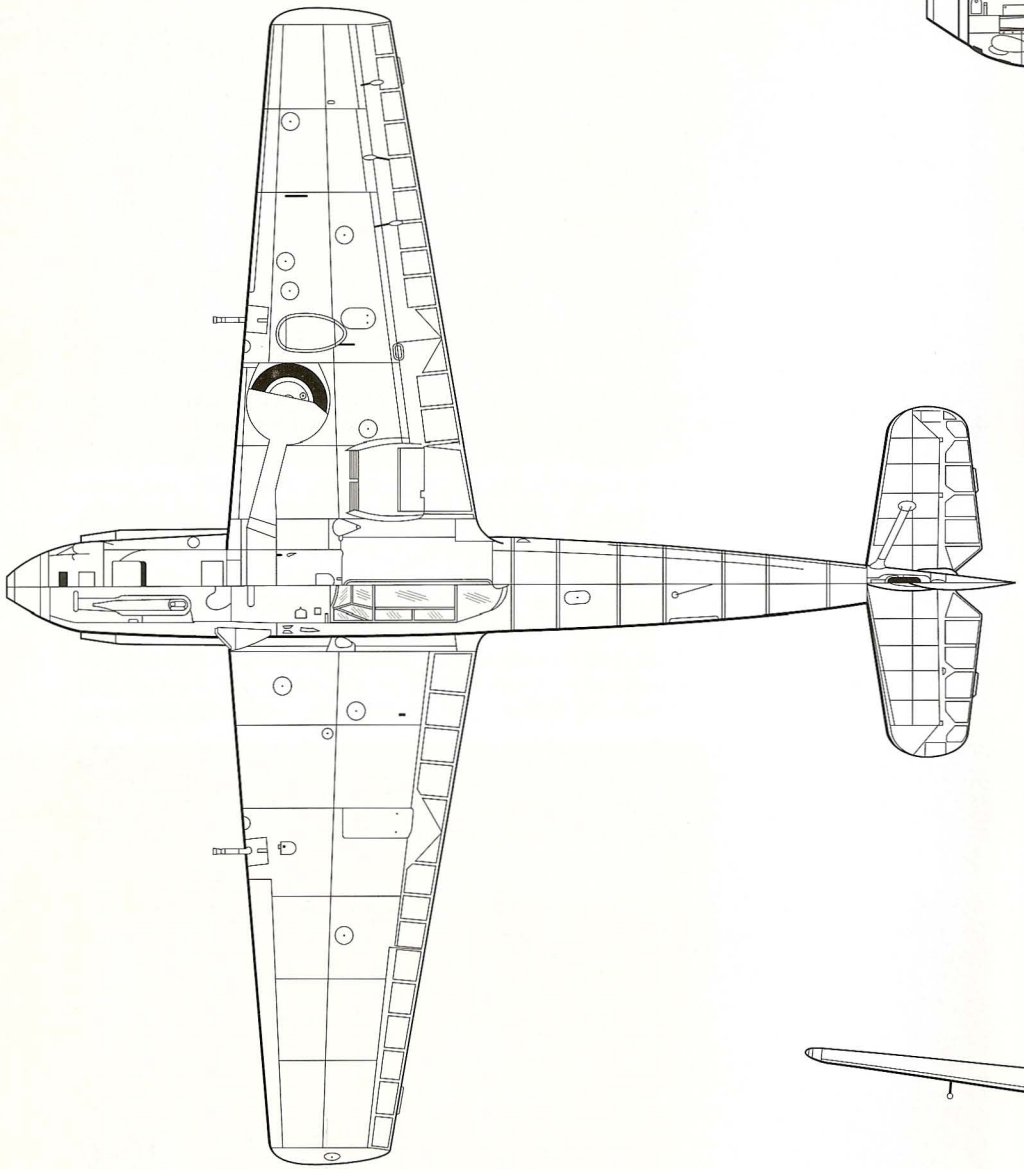
The black-outlined coolant filler access panel is located immediately aft of the propeller spinner on the port cowling. This panel was hinged at the bottom and closed with one snap-fit latch at the top. An upper cowling snap-fit latch is located immediately beside the coolant access panel.

Six exhaust stacks are mounted on each side of the Bf 109E's nose. An access panel immediately above the stacks allowed easy access to the spark plugs and their wiring. JG 51's Bf 109Es displayed this Wing insignia during the Battle of Britain. A small circular blister – believed to provide engine mount clearance – is located to the upper left of this insignia. The blister aft on the engine cowling was for the port MG 17 machine gun.



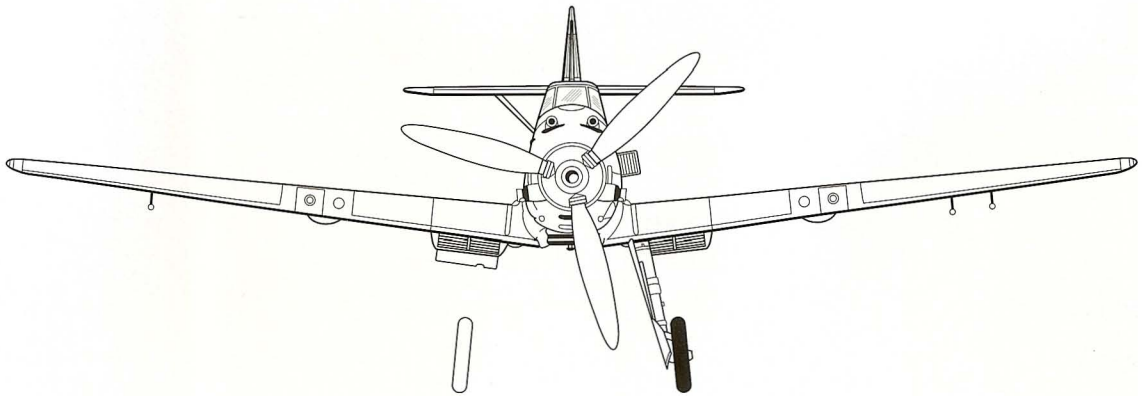




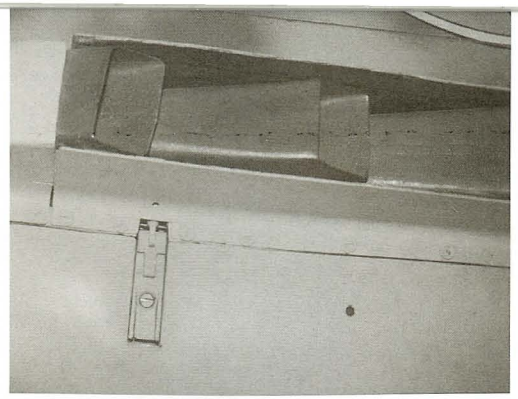


Messerschmitt Bf 109E-3 Specifications

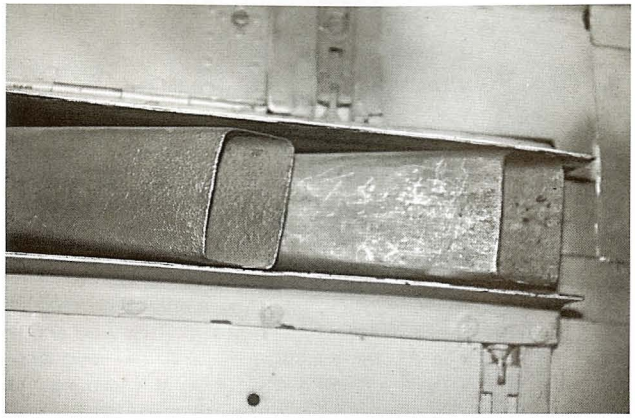
Wingspan:.....9.9 M (32 feet 5.8 inches)
Length:.....8.8 M (28 feet 10.5 inches)
Height:.....2.6 M (8 feet 6.4 inches)
Wing Area:.....16.4 M^2 (176.5 square feet)
Empty Weight:.....1865 KG (4112 pounds)
Maximum Weight:.....2610 KG (5754 pounds)
Powerplant:.....One 1175 HP Daimler-Benz DB 601A 12-cylinder, liquid-cooled, inline engine.
Armament:.....Two 20MM Rheinmetall (Oerlikon) MG FF cannon with 60 rounds per gun (RPG) in the wings and two 7.92MM Rheinmetall-Borsig MG 17 machine guns with 1000 RPG in the upper forward fuselage.
Performance:
Maximum Speed:.....555 KMH (345 MPH) at 5000 M (16,404 feet)
Service Ceiling:.....10,300 M (33,793 feet)
Maximum Range:....665 KM (413 miles)
Crew:.....One

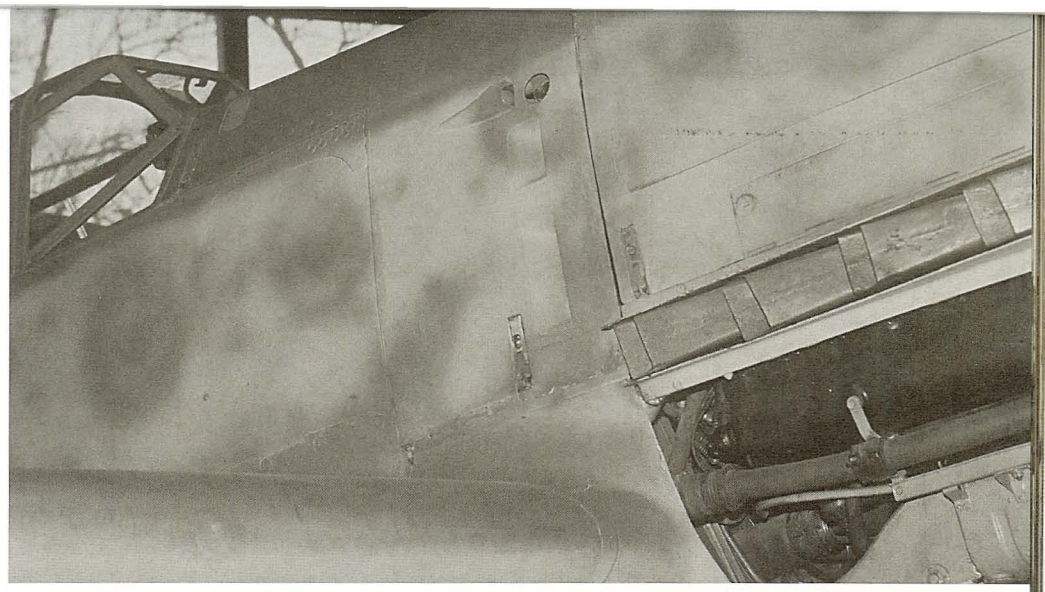


The two front port exhaust stacks are located immediately above one of the flush snap-fit engine cowling fasteners. Using this type of fastener helped remove the lower cowl without the help of tools. This allowed quick access in the field and eliminated the danger of loose screws, which was usually the case during the field maintenance.



Horizontally mounted L-shaped strips are mounted above and below the last two port side exhaust stacks. These sheets were typical on Bf 109s and were attached to the airframe with bolts.

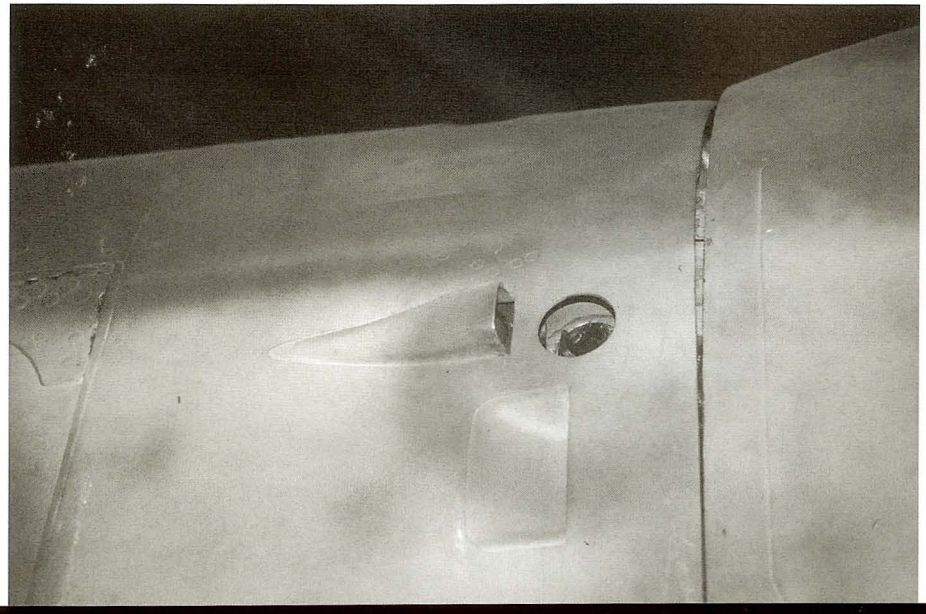


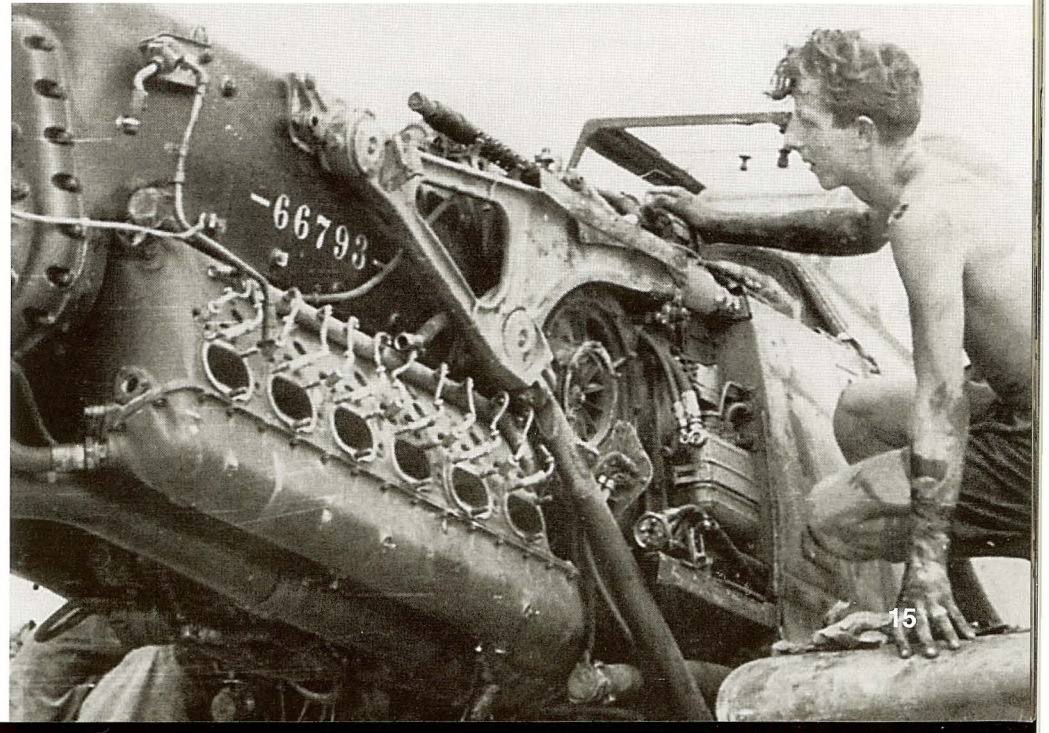


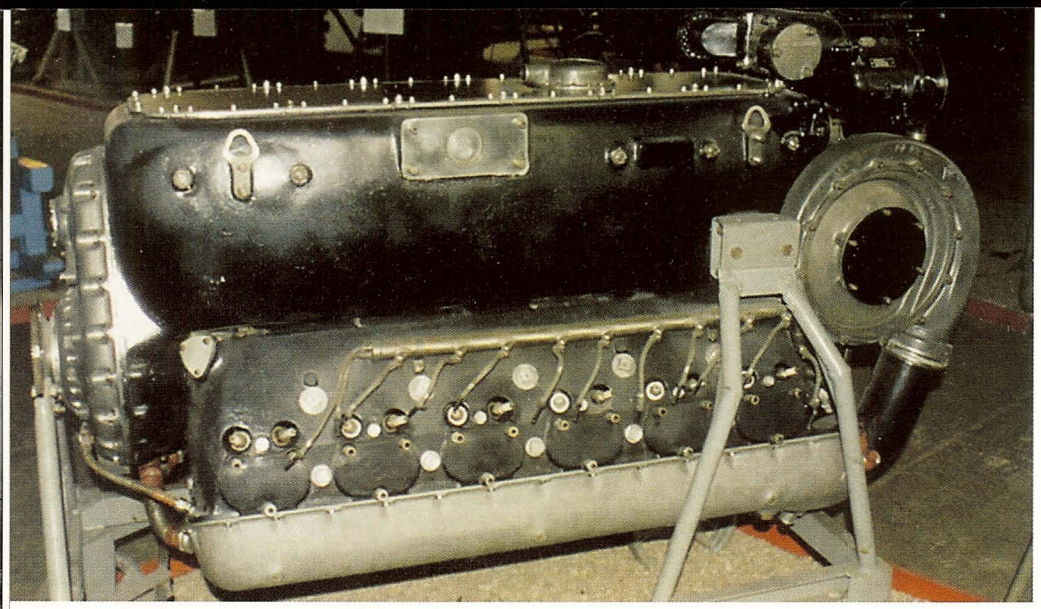
A circular aperture for the engine starting crank is mounted on the Bf 109E's starboard side. The hand crank started the DB 601A engine; electric starters were never installed on any Bf 109s.

Bf 109E ground crews had easy access to the Daimler-Benz DB 601A engine when all engine cowl panels were removed. These panels were attached to the airframe using snap enclosures, which saved time in removing and reinstalling the panels. Contemporary British fighter aircraft employed screws, which were more time consuming to remove and reinstall than the German snap enclosures. (*Bundesarchiv*)

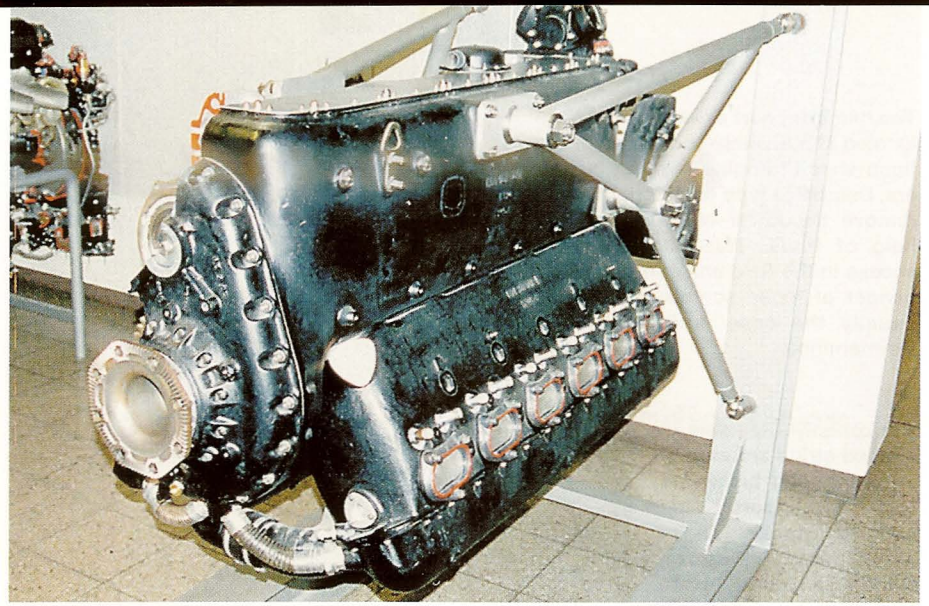
The manually operated starter aperture was placed immediately aft of the engine cowling. A hand crank placed inside the opening drove a flywheel that turned over the engine. An engine accessory bay air outlet is located immediately below the starter aperture. A small cooling air scoop is mounted immediately aft of this aperture.





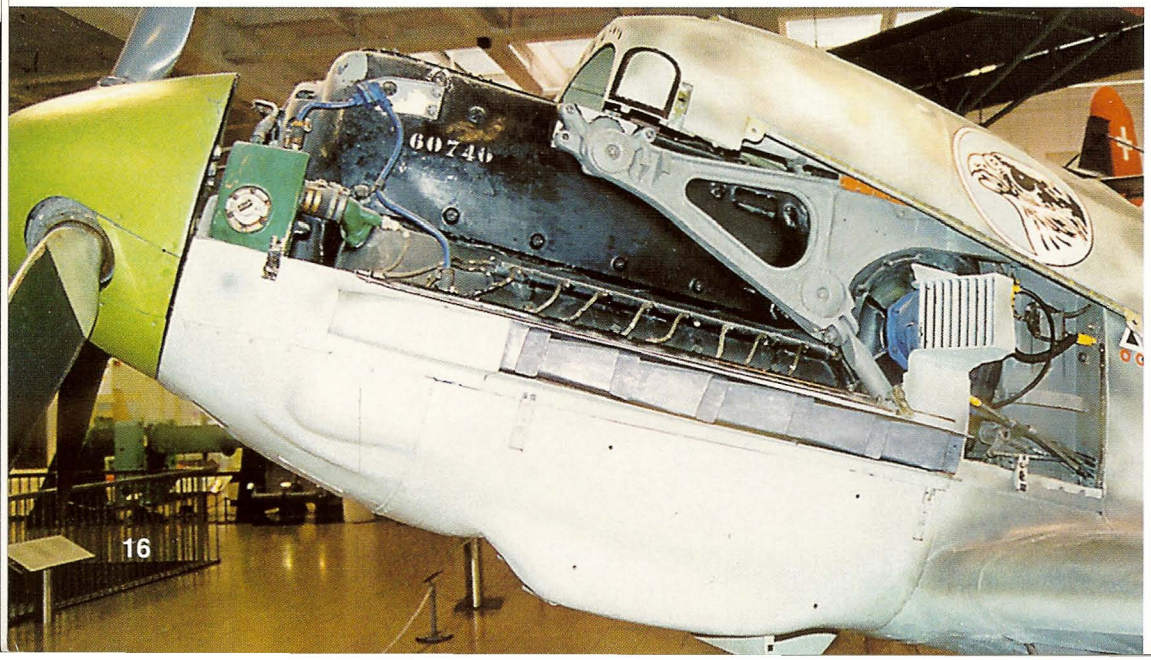


A DB 601 engine is displayed at the *Deutsches Museum* in Munich, Germany. Daimler-Benz adopted the inverted-vee configuration to allow an improved view over the nose and to easily accommodate machine guns above the engine. The circular engine supercharger is mounted on the aft engine section. The first DB 601 engine was tested in 1935 and it entered production one year later. (Jozef And´al)

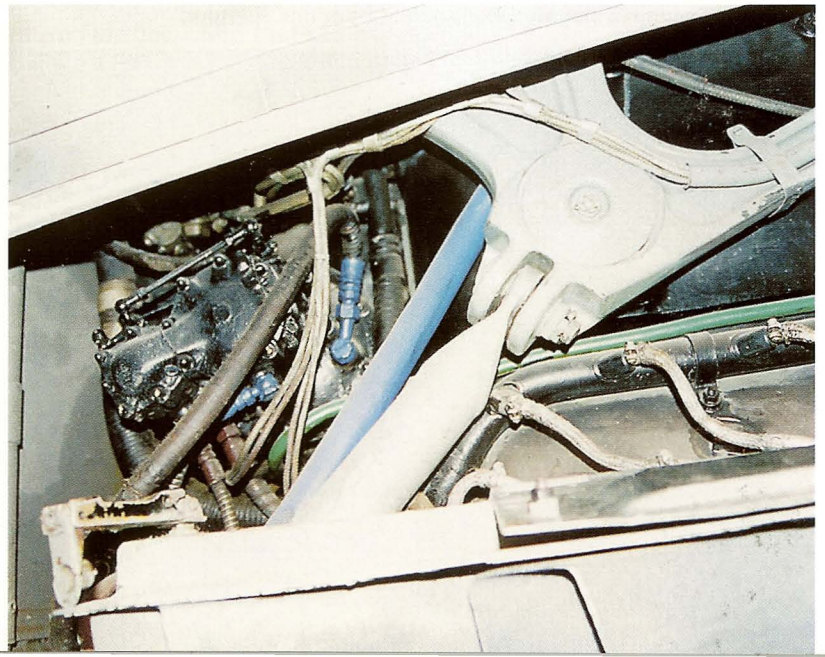


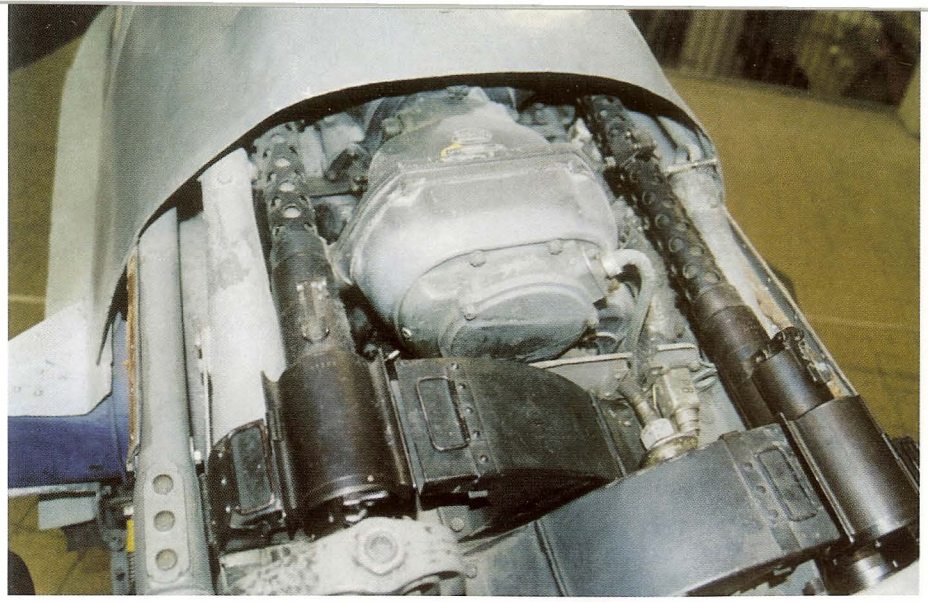
Another DB 601 is mounted on a stand in a similar fashion to the engine mounting on the Bf 109E. This engine employed fuel injection, which allowed the Bf 109E to maintain power during negative G maneuvers. Carburetor-equipped engines – including the Rolls-Royce Merlin on Hawker Hurricanes and Supermarine Spitfires – lost power due to fuel interruption during negative G maneuvers. (Jozef And´al)

The upper engine cowling was partially removed from the *Deutsches Museum*'s Bf 109E-3. A glycol coolant header tank is mounted immediately aft of the propeller spinner. The DB 601A was secured using port and starboard engine mounts, which were bolted to the firewall. These mounts were forged from magnesium alloy and incorporated anti-vibration pads where they contacted the engine. (Jozef And´al)

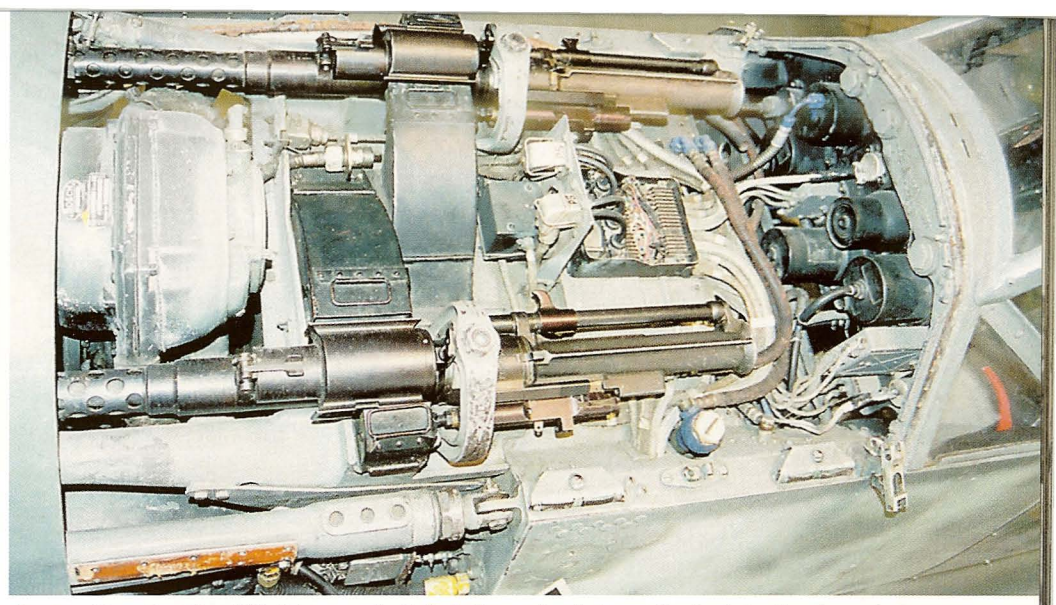


An engine mount support strut connected the engine mount with the firewall's lower section. This strut appeared on both the port and starboard sides and was secured by a bolt to the mount. Electrical wiring and piping for fuel and coolant were located immediately forward of the bulkhead. (Jozef And´al)



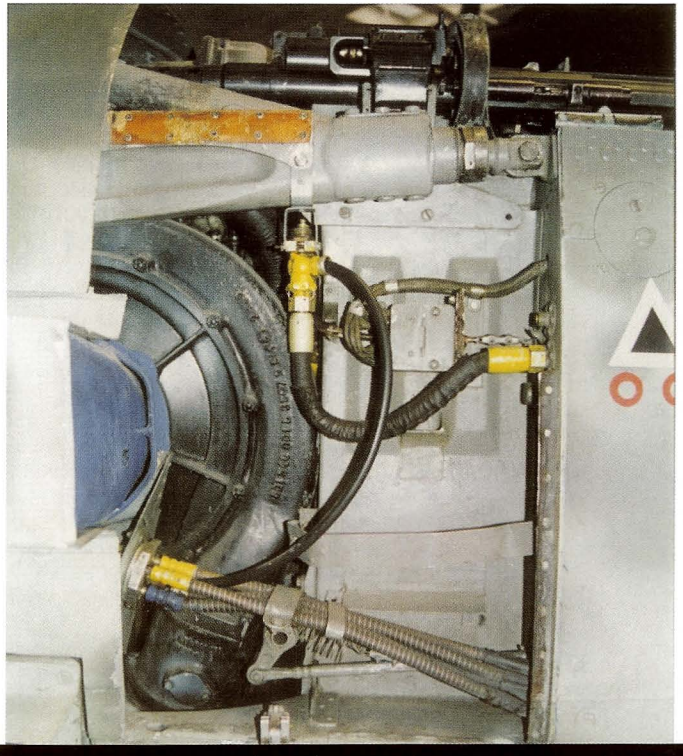


The Bf 109E-3's upper forward fuselage panel is opened to reveal the staggered 7.92MM Rheinmetall-Borsig MG 17 machine guns. These weapons were synchronized to fire through the propeller arc. Each MG 17 had a muzzle velocity of 790 M (2592 feet) per second and a synchronized firing rate of 1000 rounds per minute. The gun synchronization gear is located between the machine gun barrels. (Jozef And´al)

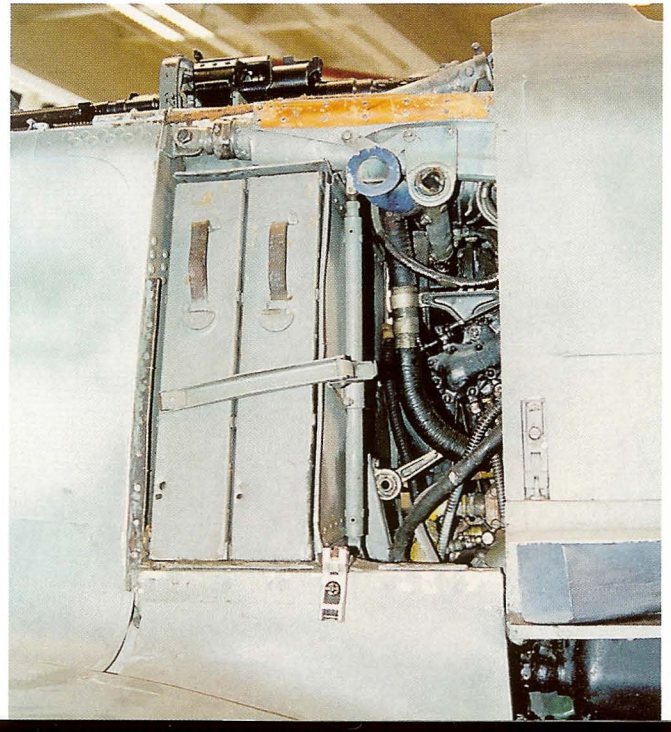


Ammunition for the MG 17s was belt fed through chutes attached to the breeches. Electrical wiring and compressed air piping for the electro-pneumatic machine gun loading and firing system are located aft of the guns. Aft sections of the cockpit instruments project through the instrument panel's rear face. This area was normally shrouded by canvas to protect the instruments from gun gases. (Jozef And´al)

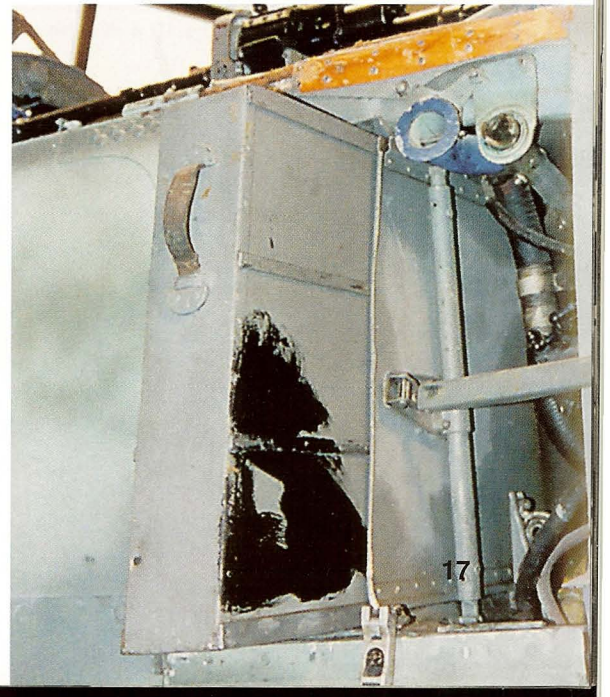
A single bolt connected each engine mount to the firewall and helped allow for easy engine changes. The circular supercharger impeller assembly was located on the port side. This impeller increased airflow into the engine for greater power. (Jozef And´al)



Ammunition for both 7.92MM MG 17s was supplied by magazines located on the starboard forward fuselage. Each magazine held up to 1000 rounds for the machine gun, with the port gun's magazine mounted forward of that for the starboard weapon. (Jozef And´al)



The port magazine was partially pulled out of the Bf 109E-3's fuselage. A leather strap handle mounted on the side aided in moving this magazine in and out of the airframe. The 7.92MM ammunition belts were folded inside the magazine. (Jozef And´al)



This Bf 109E-3 (White 1; *Werk Nummer* 1304) landed in error at Woerth near Strasbourg, France on 22 November 1939. The aircraft was assigned to 1. *Staffel* (Squadron) of JG 76 (*Jagdgeschwader*; Fighter Wing) at Frankfurt-Main, Germany during the *Sitzkrieg* ('Phony War'). It was the fourth Bf 109E-3 Messerschmitt built at Augsburg and was part of a batch of 40 aircraft. The French overpainted the undersurface *Balkenkreuze* with Green paint and added French roundels. *NE PAS POUSSER ICI* (DO NOT PUSH HERE) was painted in White on the wing leading edge. The *Armée de l'Air* (French Air Force) began evaluating this *Emil* at Orléans-Bricy airfield on 6 December 1939. It was flown in mock combat against French Dewoitine D.520 and Bloch 152 fighters. (SHAA)

The *Armée de l'Air* transferred their captured Bf 109E-3 (*Werk Nummer* 1304) to the Royal Air Force (RAF) at Amiens, France on 4 May 1940. The next day, the British flew it to the Aeroplane and Armament Experimental Establishment (A&AEE) at Boscombe Down, England. The RAF replaced the French roundels with British roundels, overpainted *NE PAS POUSSER ICI* on the wing leading edges, and assigned the serial number AE479. This Bf 109E-3 retained the JG 76 insignia on the forward fuselage. This *Emil* was reassigned to the newly-formed No 1426 (Enemy Aircraft) Flight at Duxford, England on 11 December 1941. (Imperial War Museum)

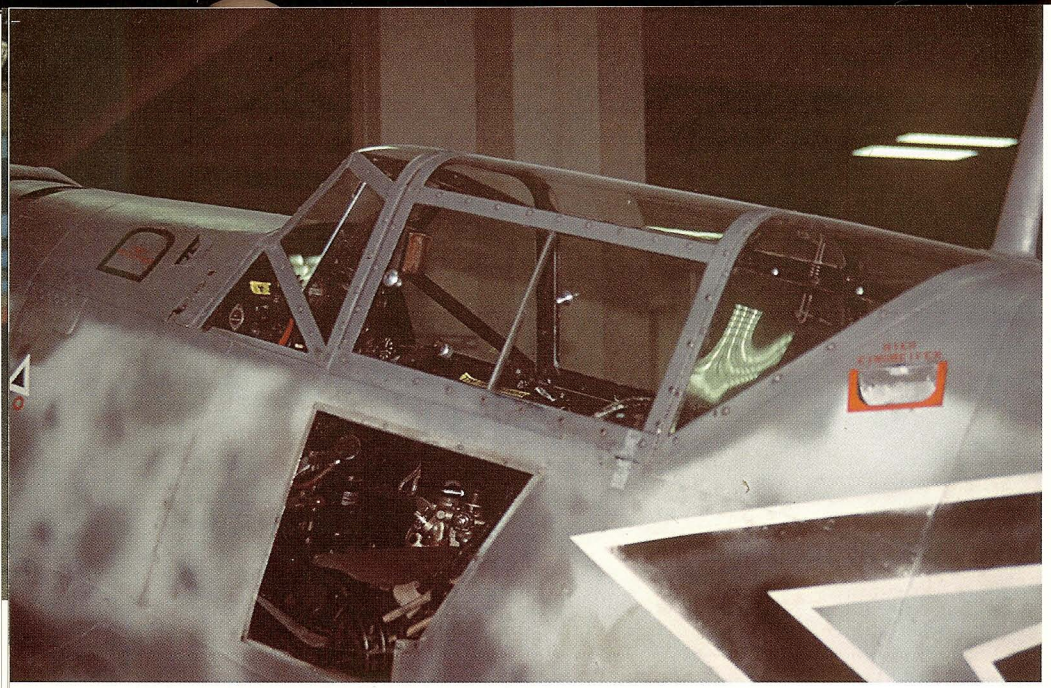
The captured Bf 109E-3 (*Werk Nummer* 1304) is parked at Wright Field (now Wright-Patterson Air Force Base), Ohio in 1942. On 7 April 1942, this *Emil* was dismantled and loaded aboard the SS DRAMMESFJORD. This ship arrived in the United States on 14 May 1942 and the Bf 109E-3 was sent to Wright Field for testing by the United States Army Air Forces (USAAF). This was the first captured Axis aircraft tested in America during World War Two. The USAAF removed both wing-mounted 20MM MG FF cannon during their trials. It retained its RAF markings and serial number AE479 during its evaluation in the US. The aircraft number White 1 and the JG 76 insignia were overpainted and the propeller tips were painted Yellow. This fighter was damaged beyond repair in a forced landing at Cambridge, Ohio on 3 November 1942. (National Archives)

One of five Bf 109E-3s Germany sold to the Soviet Union sits at snow-covered Chalovskaya airfield near Moscow. The Germans delivered the aircraft to Moscow in May of 1940. It was painted with RLM 70 Black Green upper surfaces and RLM 65 Light Blue undersurfaces. The Soviets evaluated this and the other four *Emils* received under the 1939 German-Soviet Non-Aggression Treaty. (G.F. Petrov)

A Slovak pilot stands before his Bf 109E-4 at Piestany (Bad Pistyan), Slovakia in 1943. The Slovak national insignia – a White-trimmed Blue *Balkenkreuz* with a Red disc – was painted on the fuselage and wings. A RLM 04 Yellow aft fuselage band identified Axis aircraft on the Eastern Front. Germany supplied 19 Bf 109Es to the *Vzdusne zbrane* (Vz; Slovak Air Arm) in 1942-43 and they served until 1944. (Peter Sumichrast via Jozef And´al)

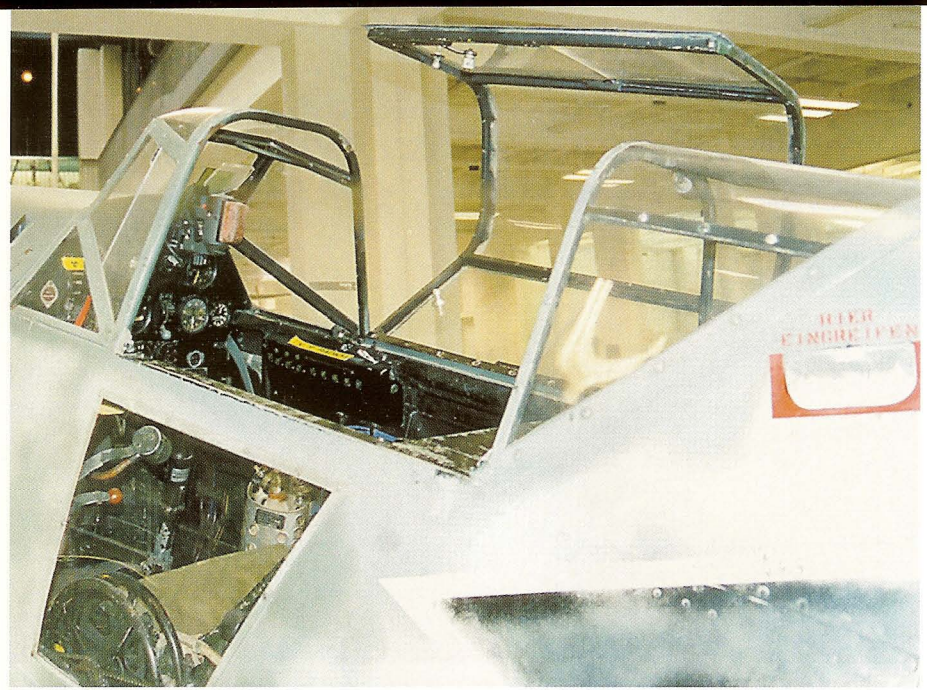
Slovak technicians maintain a war-weary Bf 109E-3 (White 92S) in the Spring of 1942. Two mechanics work on an upper engine cowling section. This aircraft is at a German flight school in Grove, Denmark, which trained Slovak pilots and ground crews on the *Emil.* This aircraft's camouflage is believed to be RLM 74 *Graugrün* (Gray Green; FS34086) and RLM 75 *Grauviolett* (Gray-Violet; FS36122) on the upper surfaces, with RLM 76 *Hellgrau* (Light Gray; FS36473) on the undersurfaces. (Boris Sudny via Jozef And´al)

A Slovak mechanic pushed the port wing of a Bf 109E-3 while its pilot warms up its engine prior to a flight. This aircraft has the pointed spinner from a Bf 109E-7. This *Emil* was assigned to the Vz's *Letka* 13 (13th Squadron) at Piestany. The Squadron insignia – a White Slovak double cross on a Red background with a Blue base – was painted on the engine cowling. (Milan Krajci via Jozef And´al)



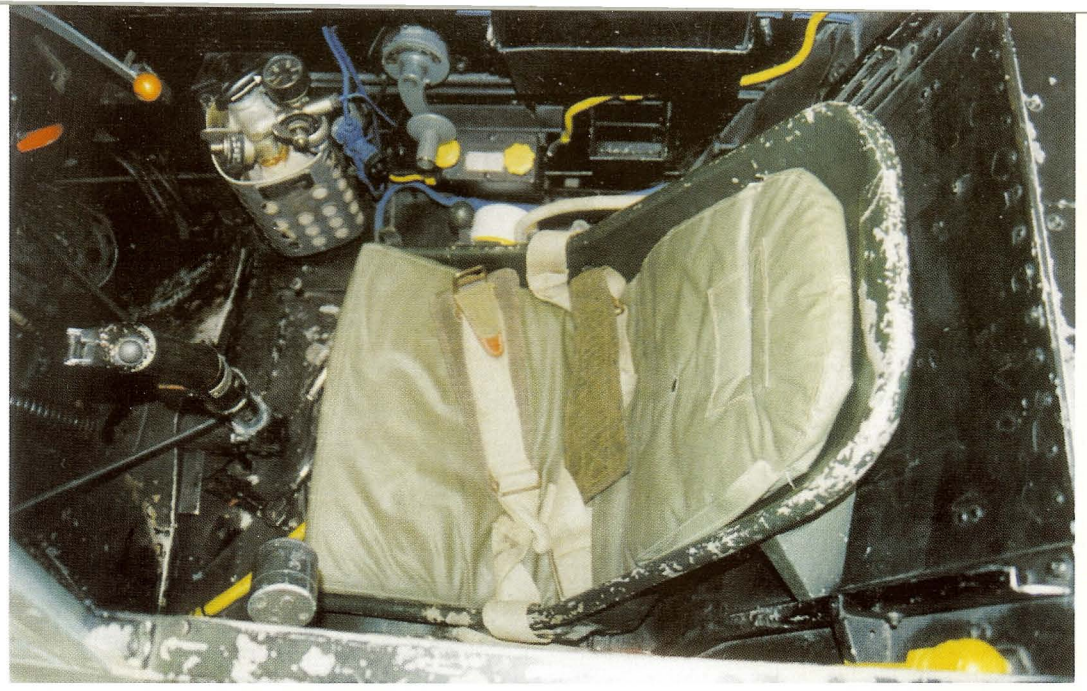
The *Deutsches Museum* replaced part of the port fuselage skin on their Bf 109E-3 with clear plastic. This allows visitors to view the *Emil*'s cockpit. An oil inspection access hatch is located in front of the canopy frame. (Jozef And´al)

The Carl Zeiss Revi C/12D reflector gun sight is mounted on the upper section of the Bf 109E-3 instrument panel. The first row of instruments includes (from left): altimeter, compass, and manifold pressure gauge. Below this are the pitot tube warning light, airspeed indicator, turn and bank indicator, propeller pitch control, tachometer, and propeller pitch indicator. Fuel, oil, and landing gear controls are placed on the lower instrument panel section. (Jozef And´al)

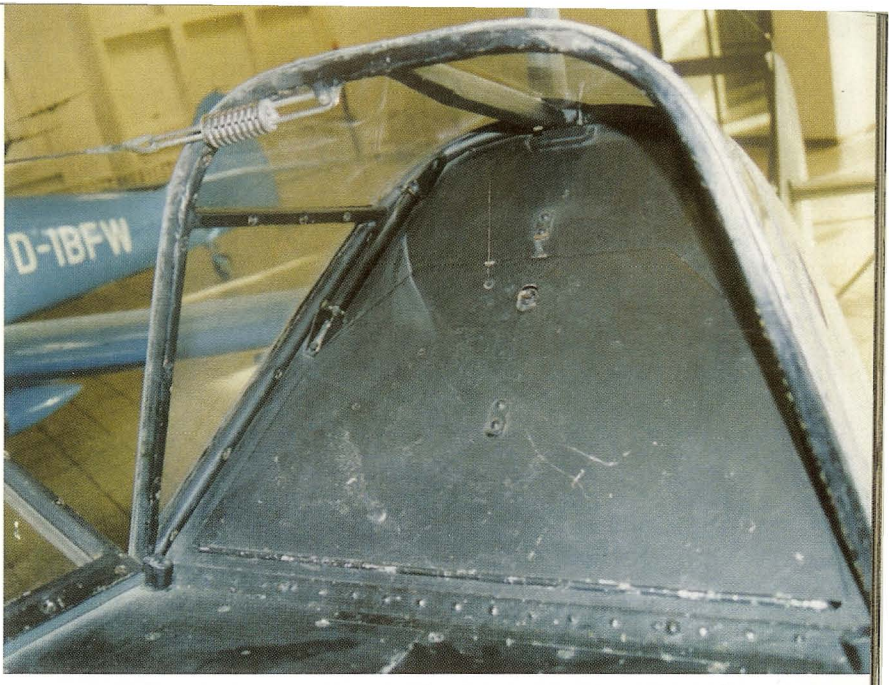


Deutsches Museum personnel opened the center canopy for improved cockpit access. The canopy hinged to starboard and was manually opened from either inside or outside of the aircraft. Aft sliding panels are mounted on the canopy center section's port and starboard sides. *HIER EINGREIFEN* (HOLD HERE) is painted in Red immediately above the flush-mounted handgrip cover behind the fixed aft canopy section. (Jozef And´al)

The flap adjustment wheel (outboard) and the horizontal stabilizer adjustment wheel (inboard) are mounted side-by-side along the port cockpit wall. The throttle lever is mounted above and forward of the two adjustment wheels. A control stick is located on the cockpit floor immediately forward of the seat. Bf 109E cockpits were normally painted RLM 02 *RLM-Grau* (RLM Gray; FS36165), with RLM 66 *Schwarzgrau* (Black Gray; FS36081) instrument panels. (Jozef And´al)

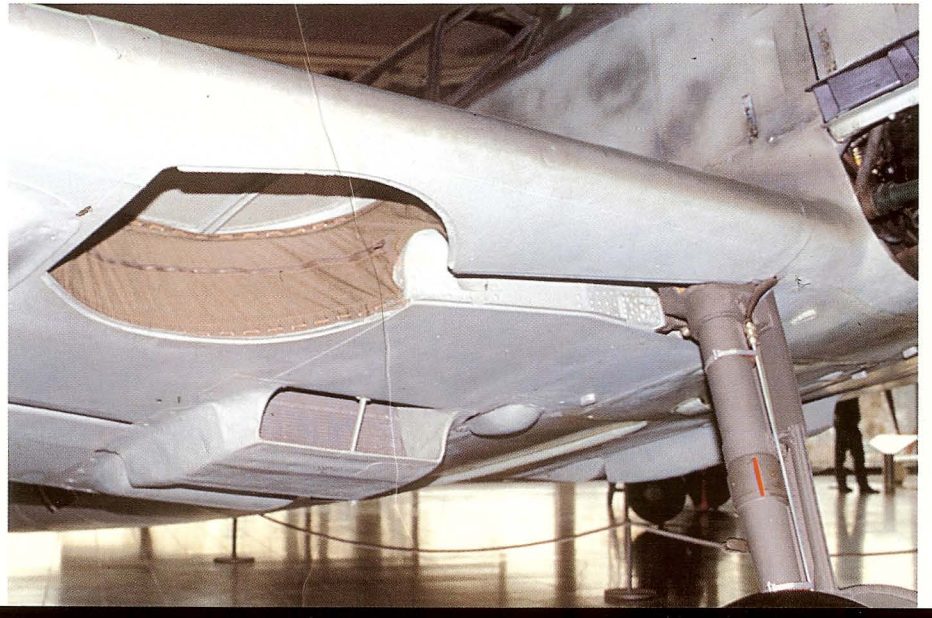


The fuel filter hand pump, with its round yellow knob, is mounted on the starboard instrument panel side near the cockpit wall. Aft of this handle is an oxygen regulator, which is across from the control stick. Immediately aft of the oxygen regulator are the coolant radiator flap control (top) and the remote control ventilator, while the yellow fuel primer pump is below these controls. A map holder is placed high along the cockpit wall. (Jozef And´al)

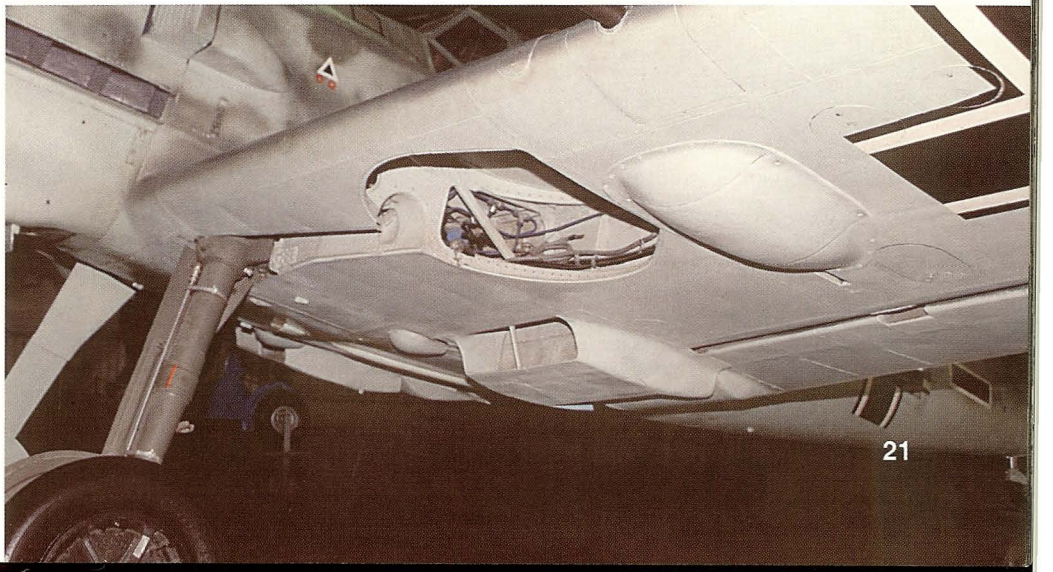


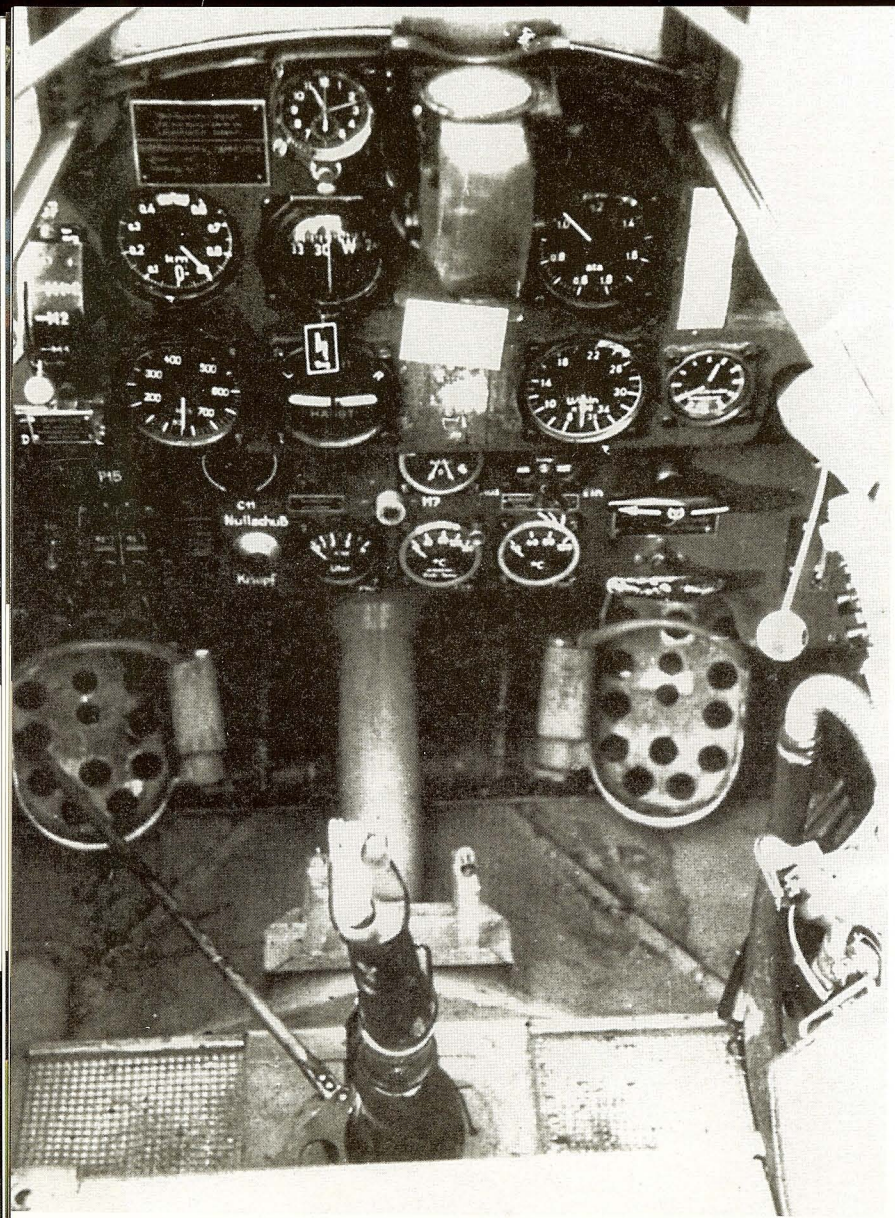
Access to the rear fuselage is through this plain bulkhead located inside the fixed aft canopy section. A hinge runs parallel with the bulkhead's lower surface. This Bf 109E-3 lacked the 8MM aft cockpit armor plate installed on Bf 109E-4s and later *Emils*; however, some E-1s and E-3s were retrofitted with this armor. A spring attached to the canopy frame is connected to a restraining cord fitted to the opened center section. The 400 L (106 gallon) fuel tank is located immediately aft of and below this bulkhead. (Jozef And´al)

Bf 109E-3 main landing gear bays were mounted inside the inboard wing undersurfaces. Bay walls were usually covered by either canvas (here) or leather, which kept foreign objects out of the wiring inside these wells. A zip fastener allowed mechanics to access the inner gear bay. Bf 109E landing gear bays and struts were painted RLM 02 *RLM-Grau* (RLM Gray; FS36165). (Jozef And´al)



The canvas cover is removed from the port gear bay on this Bf 109E-3. This exposed wiring for 20MM MG FF cannon mounted immediately outboard of the well. The *Emil*'s 2 M (6 feet 6.7 inch) wide gear track led to several taxiing accidents and was one of this fighter's weak points. (Jozef And´al)



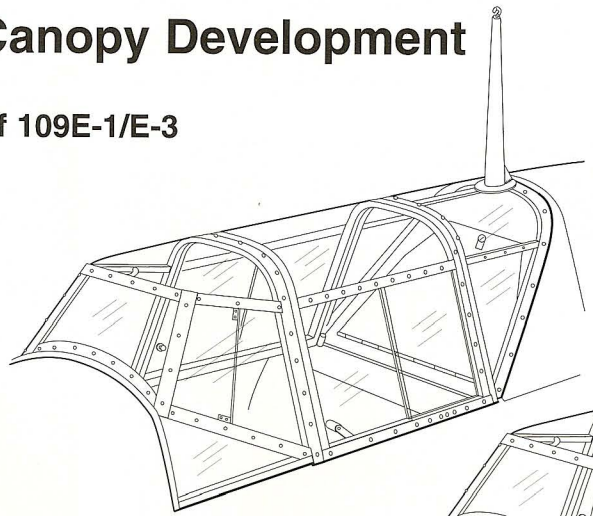


The Bf 109E-7 instrument panel differed in several details from early *Emils*. This included the flap and landing speed data plaque mounted on the panel's upper left section. A clock is fitted between this plaque and the Revi C/12D gun sight. Other instruments were the same as for earlier Bf 109Es. A safety cover for the machine gun trigger is mounted atop the control stick. Bf 109 rudder pedals were raised to approximately the same level as the seat's lower edge and were angled slightly outward. This arrangement allowed the pilot to better resist G (gravity) forces. Circular lightening holes cut into the rudder pedals saved weight.

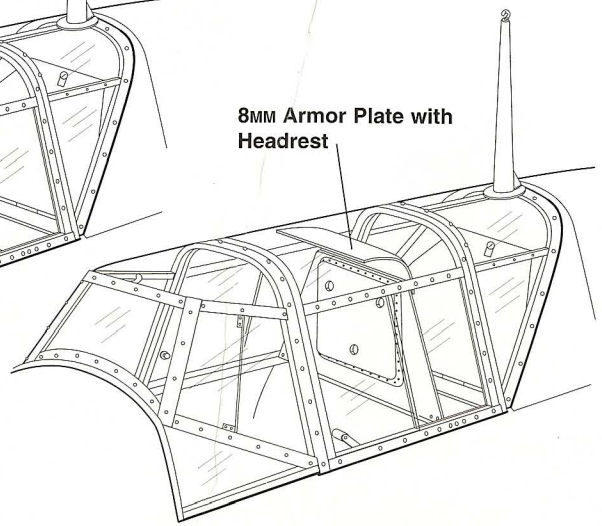
This *Aeronautica Regalã Românã* (ARR; Royal Romanian Air Force) Bf 109E-3 was retrofitted with a 58MM armored glass windshield, which was mounted in front of the original plexiglas windshield. Additionally, an armor plate panel was fitted in the rear canopy frame. *Hai fetito!* (C'mon lassie!) is painted in White on the RLM 04 Yellow nose. The five White bars below the cockpit tallied ground attack mission markings, not Soviet aircraft kills. (Dan Antoniu)

Canopy Development

Bf 109E-1/E-3

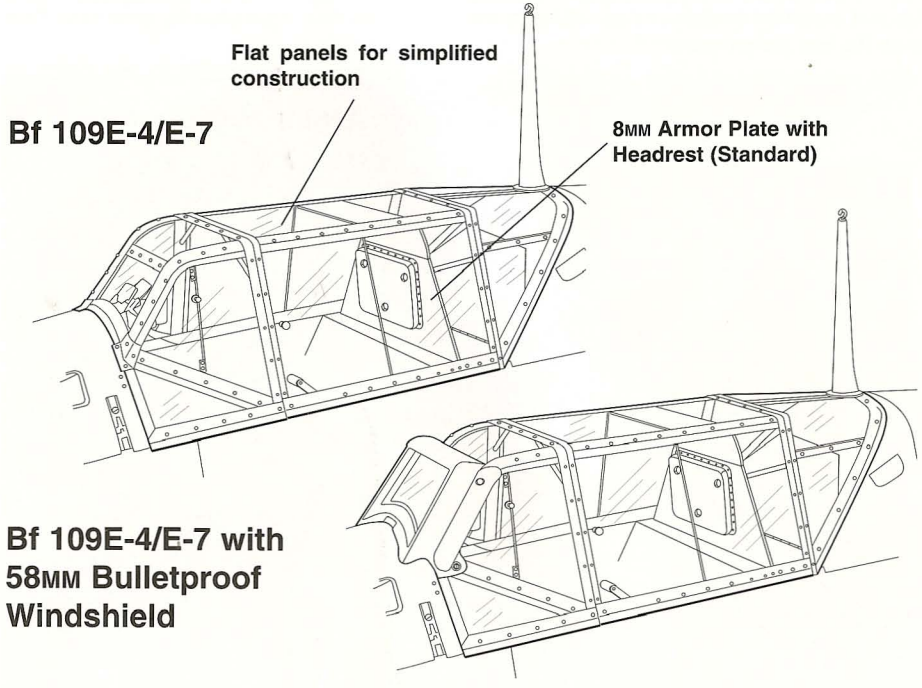


Bf 109E-1/E-3 with Armor Protection Retrofit



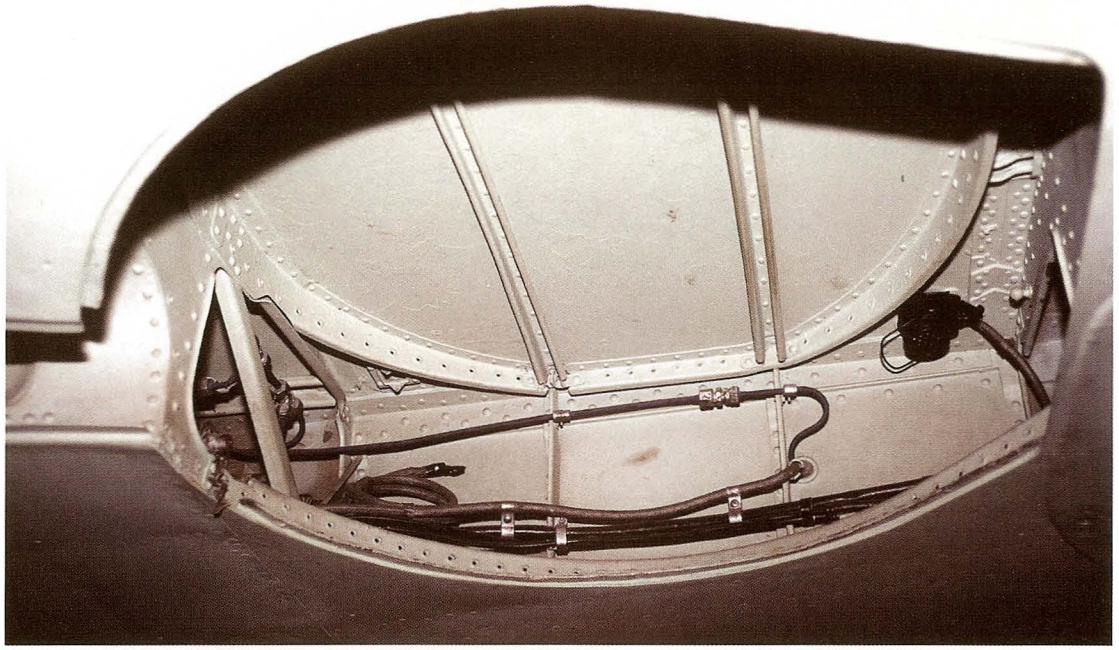
Several Bf 109E-3s – including aircraft 17 – were retrofitted with a rear view mirror atop the canopy frame. This field modification gave the pilot improved visibility to the rear. The Bf 109E-3 has the original canopy configuration without armor protection on the rear canopy frame. The insignia of 2./Erg JGr Merseburg (*Ergänzungs Jagdgruppe*; Replacement Fighter Group), an advanced training unit, is painted under the windshield. (Manfred Griehl)

Additional 58MM armored glass is mounted to this Bf 109E-4's windshield. The rear of the opened canopy was fitted with the armor plating that was standardized on this sub-variant. Several earlier Bf 109E-1s and E-3s were retrofitted with the rear armor plating. The Bf 109E-4's canopy was more angular than on earlier Emils and reduced production time. (*Bundesarchiv*)


Flat panels for simplified construction
Bf 109E-4/E-7
8MM Armor Plate with Headrest (Standard)
Bf 109E-4/E-7 with 58MM Bulletproof Windshield

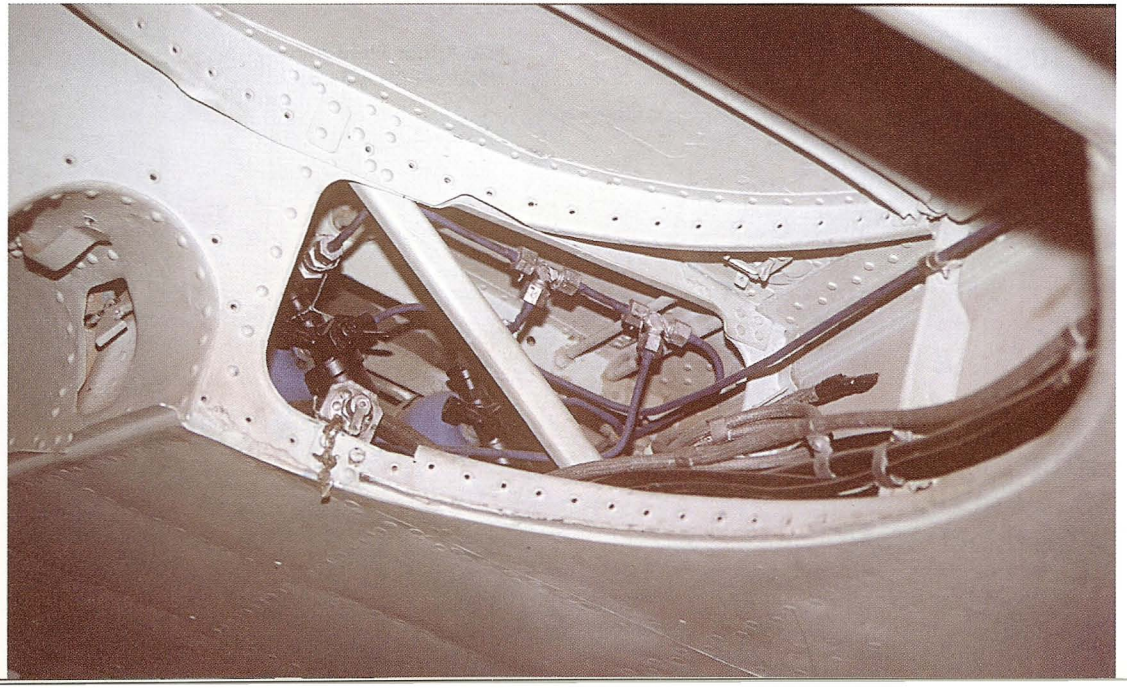
An ARR Bf 109E-3 pilot prepares for a ground support mission over the Eastern Front in July of 1941. A mechanic holds the engine starter crank in his left hand. Eight diagonal mission tally bars along the fuselage side noted the targets and dates of previous missions. Additional armored glass is mounted to this *Emil*'s windshield. (Dan Antoniu)

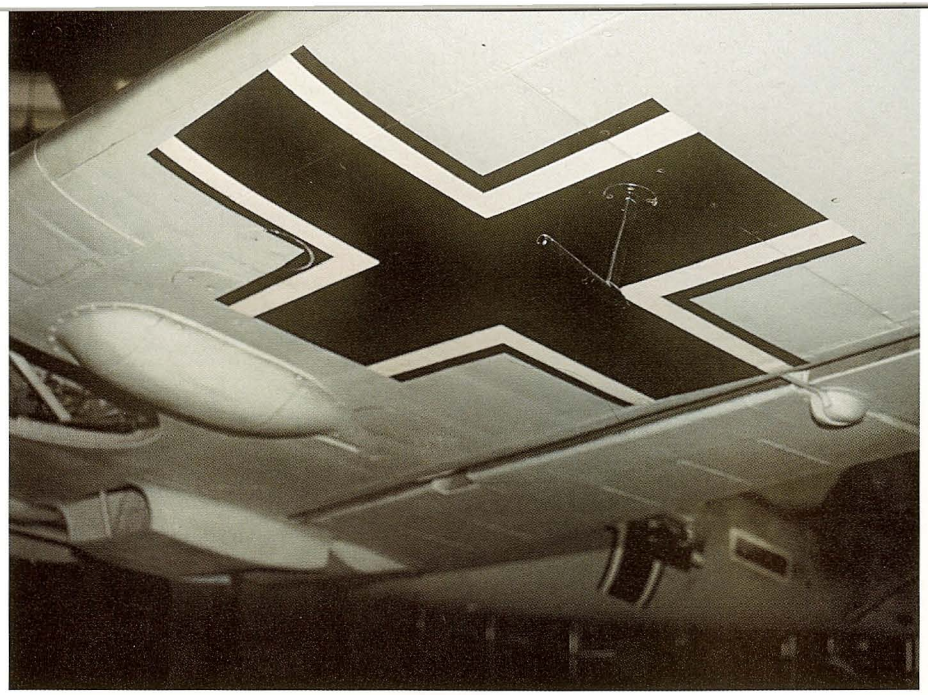
A Red position light is mounted on the port wing tip of the *Deutsches Museum*'s Bf 109E-3. The all-metal wing structure featured a single spar running along the center of its span. A streamlined balanced weight was mounted on each aileron's undersurface, while the aileron hinge is mounted outboard of the weight. The blister in the wing's center accommodated the 20MM MG FF cannon's magazine.



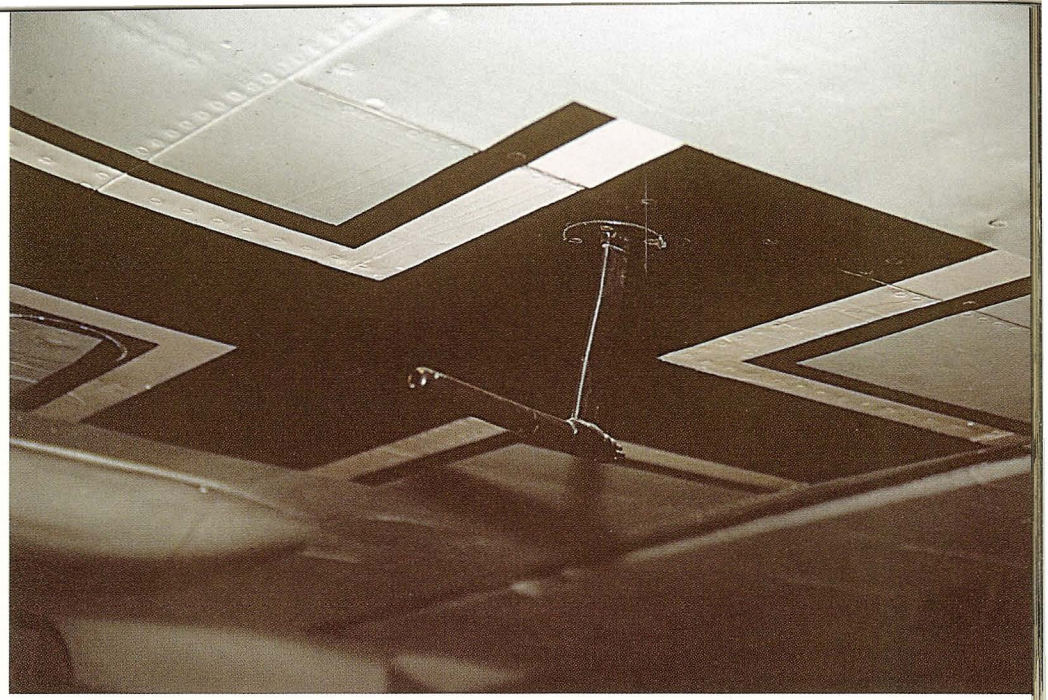
Hydraulic piping and electrical wiring run along the port main landing gear bay wall. This arrangement was duplicated on the starboard side. The canvas bay wall covering was removed to provide access to this airframe section. Reinforcing ribs were mounted in the bay's ceiling.

A diagonal stabilizing rib beside the main landing gear well connected the upper and lower wing skins. Prewar Bf 109E-3s displayed excellent craftsmanship, which is reflected in the riveting inside the gear well. This quality deteriorated as the war progressed.



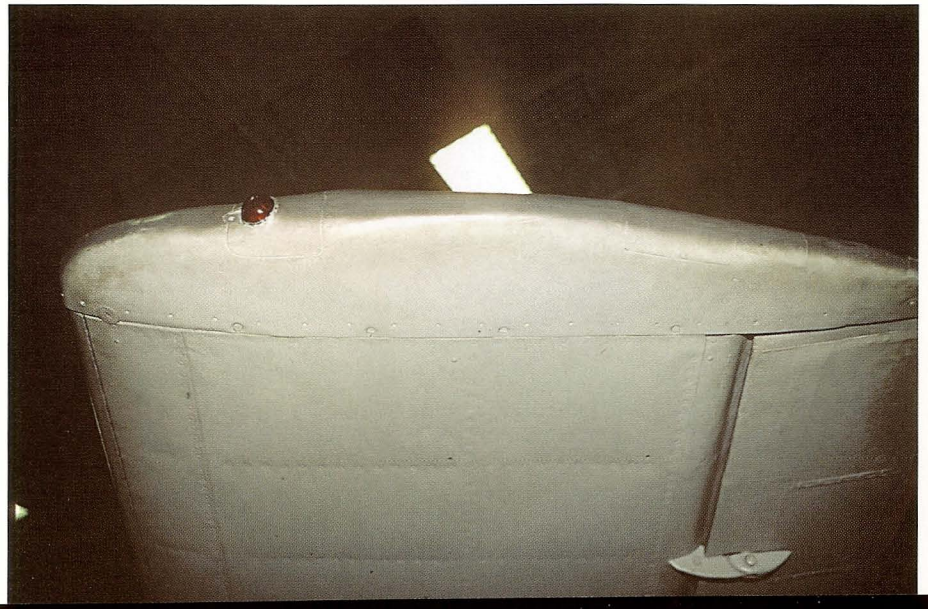


The large *Balkenkreuz* (Beam Cross) national insignia is painted on the Bf 109E-3's mid-wing undersurface. It consisted of an RLM 22 *Schwarz* (Black, FS37038) cross, with an inner border of RLM 21 White and an RLM 22 outer border. The *Trommel* (Drum) T-60 FF 20MM ammunition magazine introduced on this *Emil* sub-variant required bulges in the wing undersurfaces. Earlier Bf 109E-1s armed with wing-mounted 7.92MM MG 17s lacked this bulge.

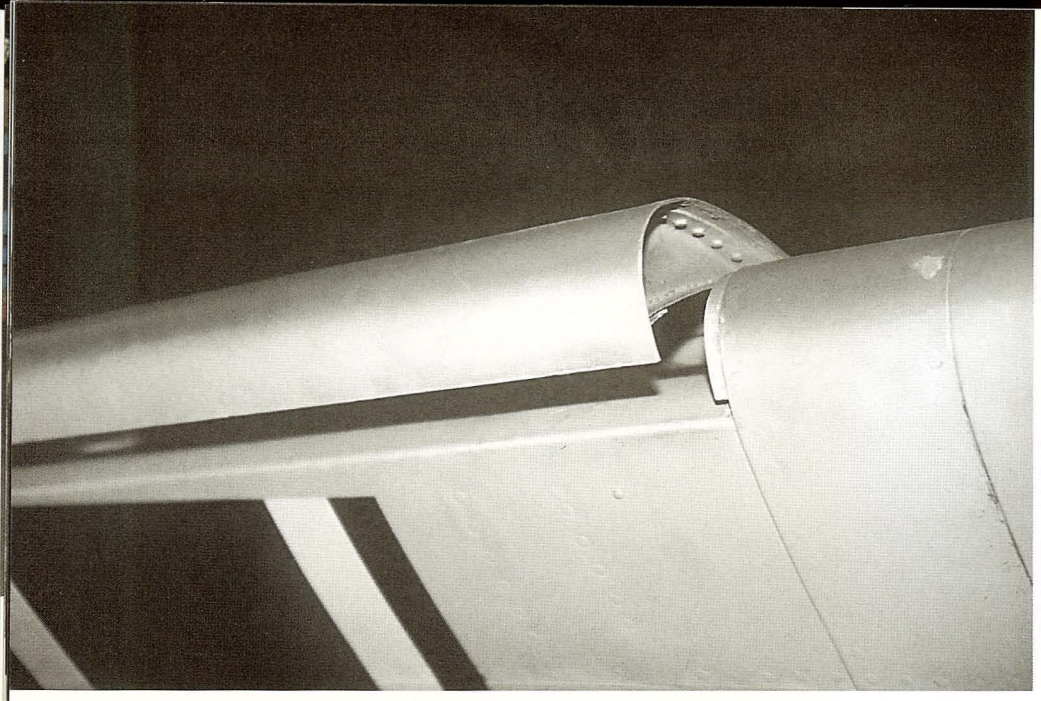


An L-shaped pitot tube was mounted on the port wing undersurface. The pitot tube collects airflow for cockpit instruments, especially the airspeed indicator. This tube is extended away from the airframe, where turbulent air would interfere with readings.

Bf 109Es had wingtips that were less rounded than on the Bf 109F and subsequent variants. These wingtip fairings were made from *Elektron* sheet, a light alloy using a high aluminum content.

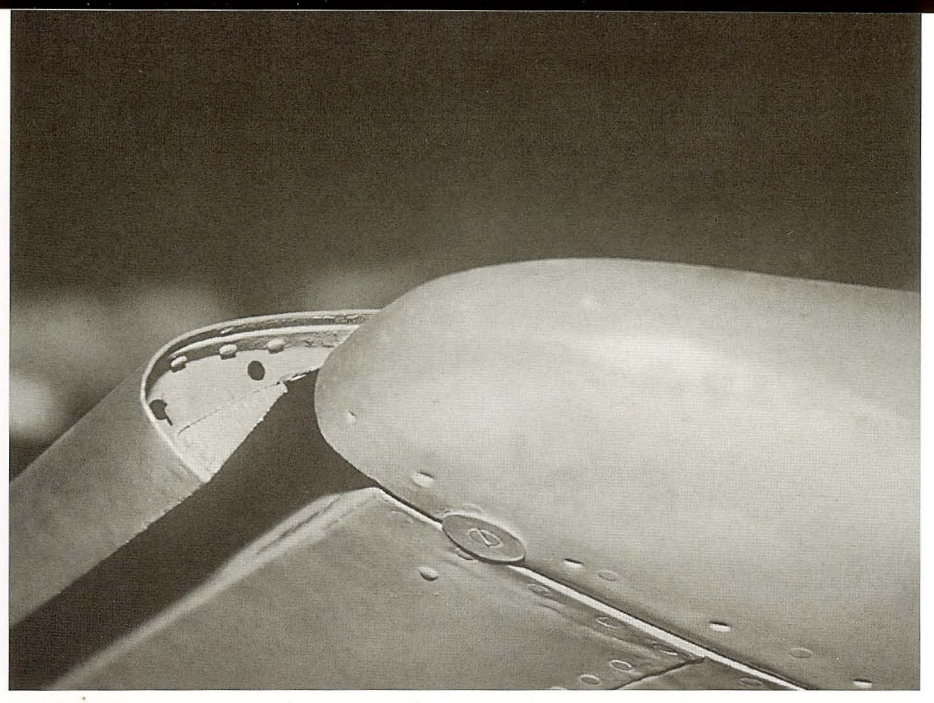


The position light was mounted in a panel on the wingtip's forward half. Bf 109E pilots usually turned on the position lights – red on the port wingtip, green on the starboard wingtip, and white on the tail – for night and low visibility flying.



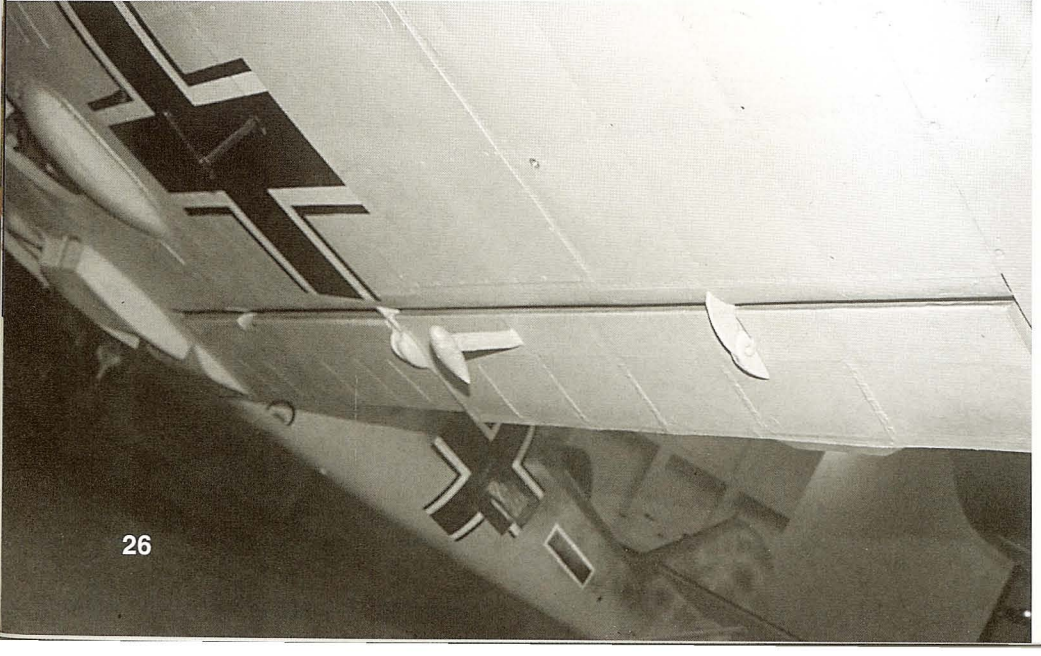
All Bf 109s – including *Emils* – were equipped with wing leading edge slats. The slats automatically extended from the wing at high angles of attack. They improved low-speed handling, including landing. The Bf 109E-3 had a landing speed of 130 KMH (81 MPH). No French or British World War Two fighters were equipped with these slats.

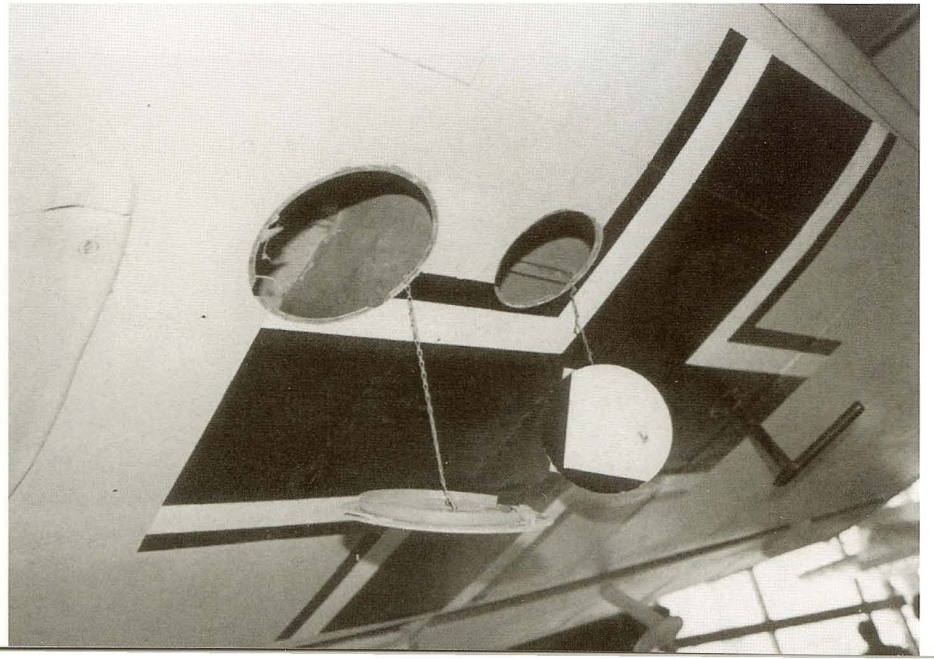
A trim tab was fitted only on the port wing flap; this tab did not appear on the starboard flap. The Germans normally painted control surface tabs RLM 23 Red. The *Deutsches Museum*'s Bf 109E-3 lacks the mooring ring mounted on the port wing undersurface. A mooring rope was fed through these rings to secure the aircraft to the ground between missions.

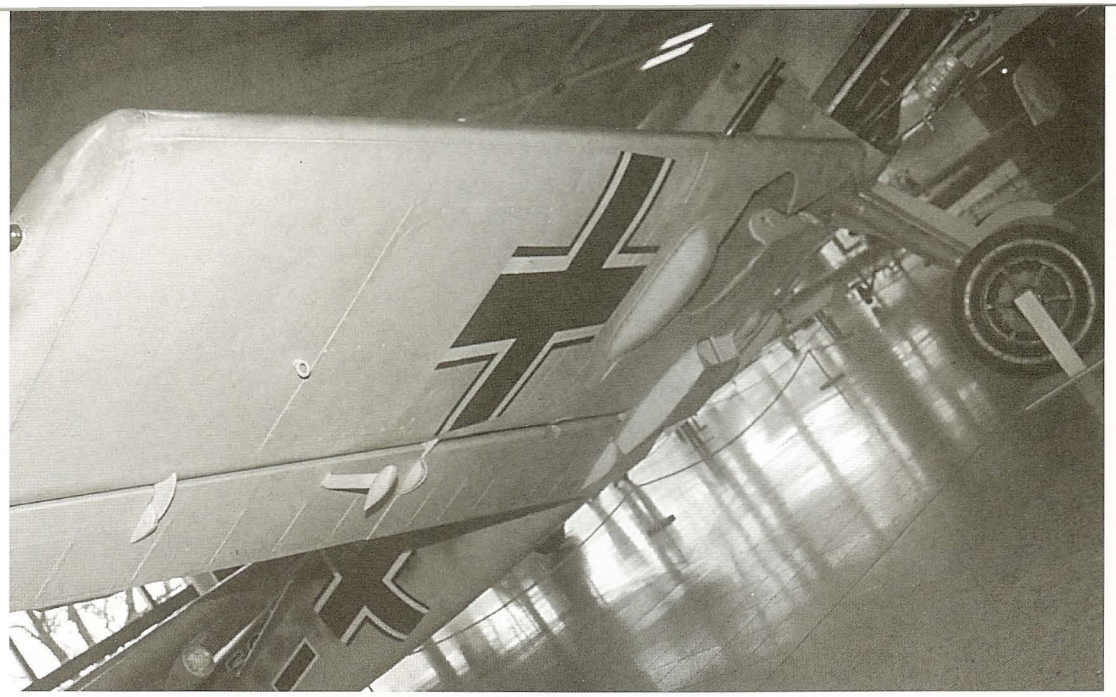


The port leading edge slat is extended from this Bf 109E-3's leading edge. Solid ribs riveted to the slats provided structural stiffening. Under the 1939 German-Soviet Non-Aggression Pact, the Soviets purchased five Bf 109E-3s for evaluation. This resulted in the Lavochkin design bureau copying these slats for their LaGG-3 and La-5 fighters.

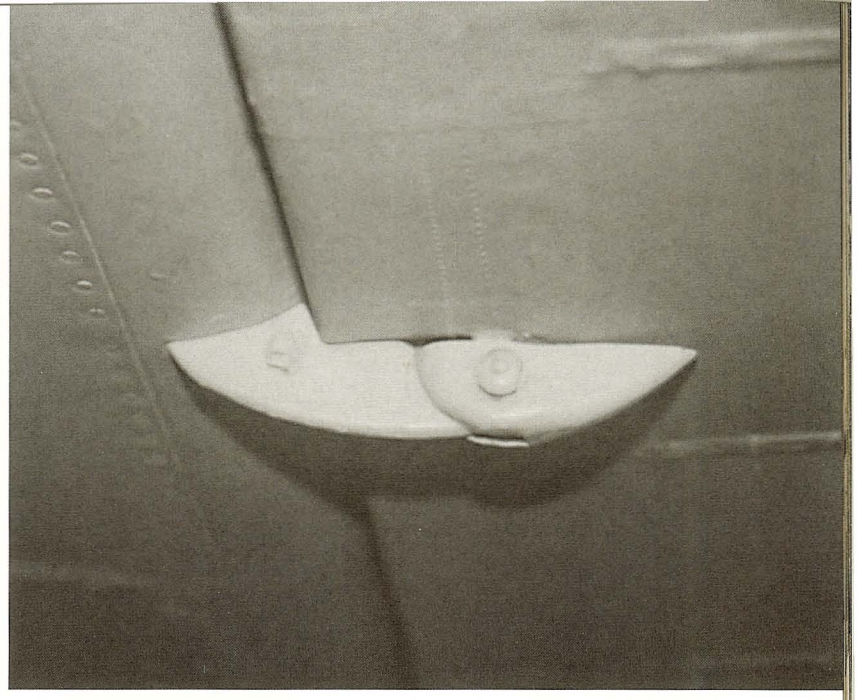
Two underwing inspection panels are opened on this Bf 109E-3's port wing. The inboard panel opened for collecting spent 20MM cannon shells, while the outboard panel allowed mechanics to check leading edge slat movement during maintenance. A chain is fastened from the wing to each panel. Ten such panels were fitted to the *Emil*'s lower wing surfaces. (Jozef And´al)





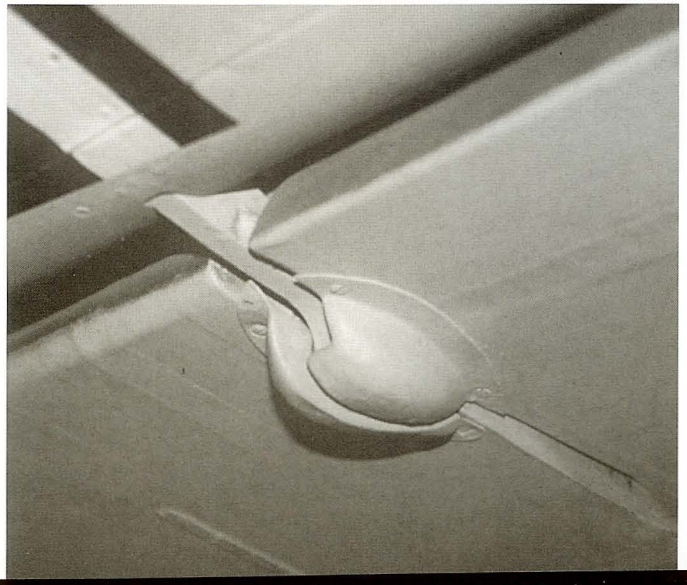


The mooring ring is mounted on the Bf 109E-3's starboard outer wing undersurface. A trim tab is not installed on the starboard flap; this tab was only found on the port flap. Bf 109E-3 pilots lowered the flaps 12° for takeoff and 42° for landing using a wheel mounted on the port cockpit wall beside the seat. A green position light is mounted on the starboard wingtip.

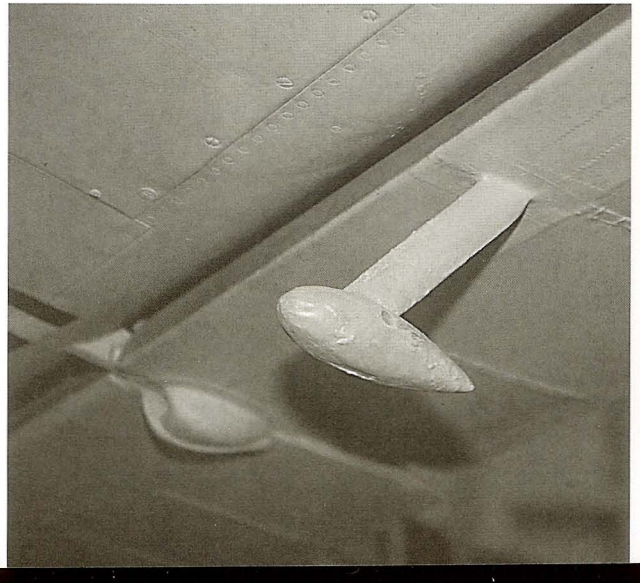


A thin outboard aileron hinge is mounted to the 12th wing rib on the undersurface. The aft hinge section moved with the aileron, while the forward portion was fixed to the wing. Bf 109s had fabric-covered ailerons and flaps, while all other wing skinning was metal. Both ailerons had a maximum deflection of +/-12°.

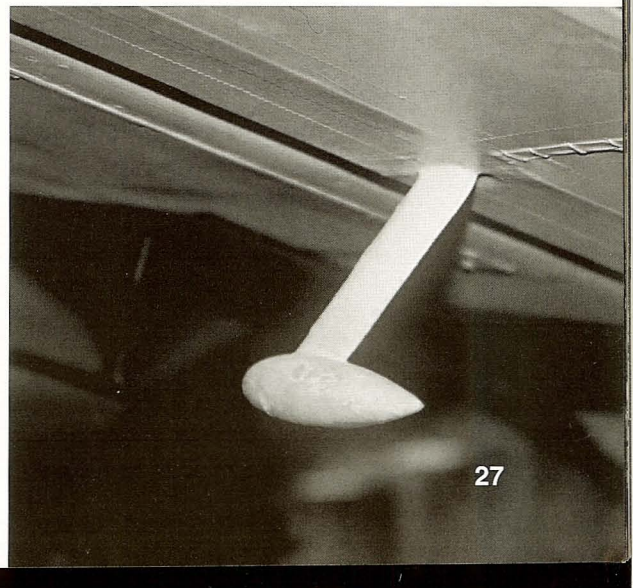
Both inboard wing aileron/flap hinges were provided with streamlined fairings. This hinge – mounted on the ninth rib – was located where the aileron and flap intersected, while the other hinge was placed near the wing root.

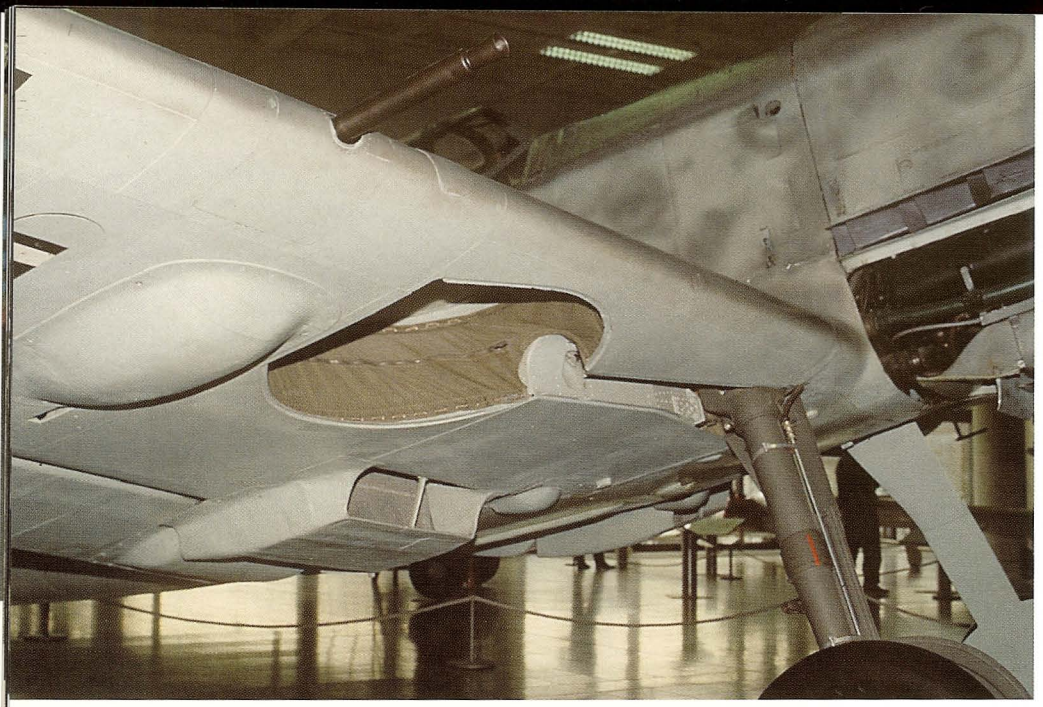


A streamlined balance weight was mounted on the undersurface of each Bf 109E aileron. This weight counteracted aerodynamic forces to reduce aileron flutter. Messerschmitt also employed this balance weight on their Bf 110 *Zerstörer* (Destroyer) heavy fighter.



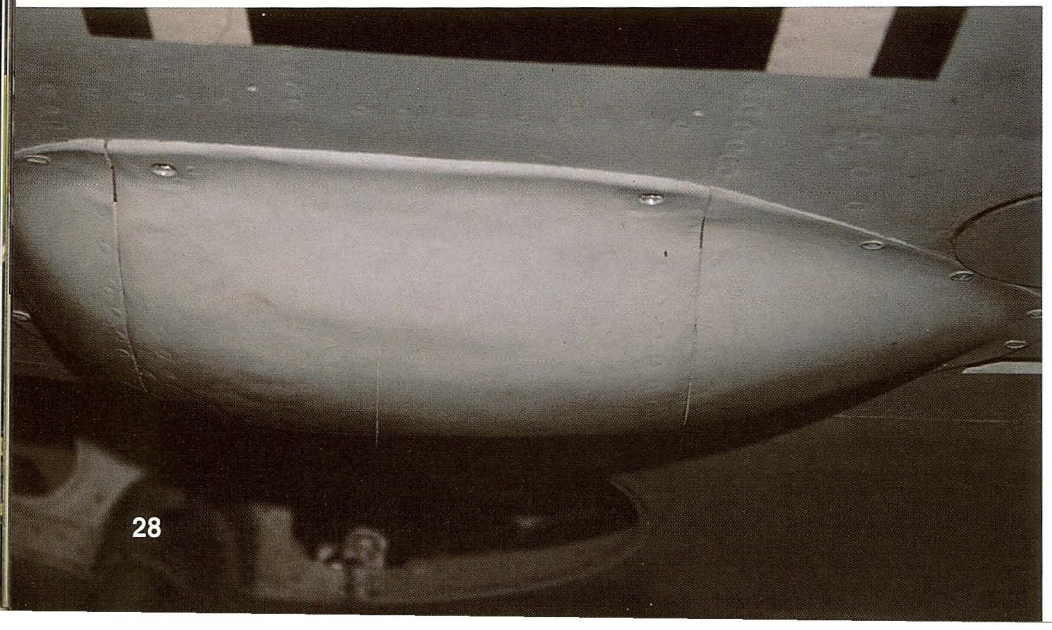
The drop-shaped balance weight is mounted at the end of a strut fitted to the aileron structure. This weight is located on the port aileron; however, the starboard balance weight was identical in both size and shape.

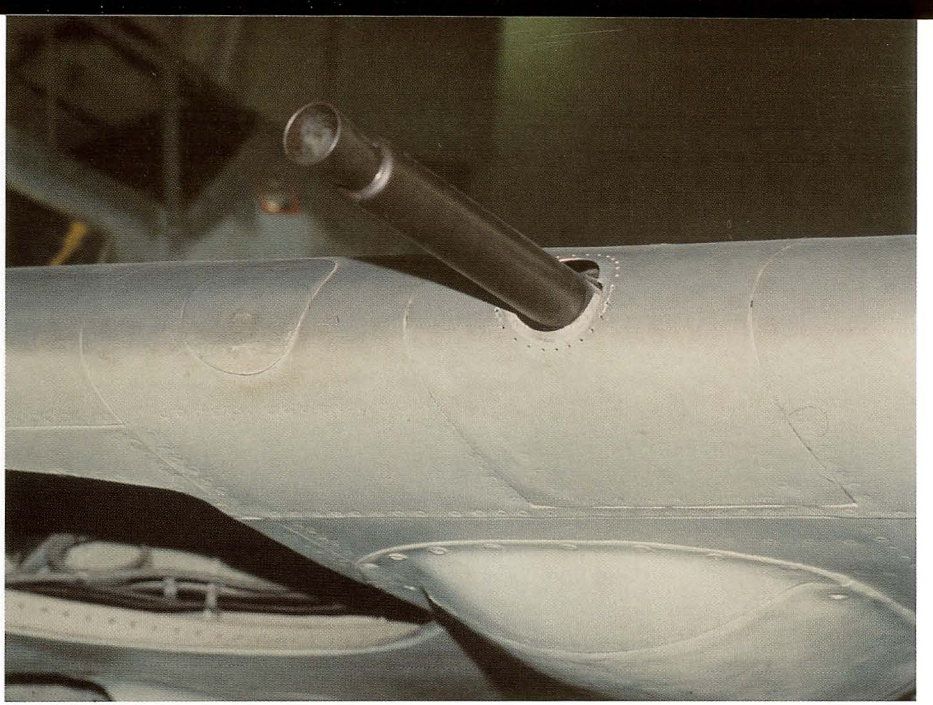




Each wing-mounted MG FF was fed from a 60-round *Trommel* T-60 FF magazine inside the wing. The Swiss firm Oerlikon developed the 20MM MG FF, which Rheinmetall-Borsig built under license in Germany. This weapon had a muzzle velocity of 600 M (1968.5 feet) per second and a firing rate of 520 rounds per minute. The MG FF fired High-Explosive Incendiary-Tracer (HEI-T), Armor-Piercing (AP), Armor-Piercing Incendiary (API), and various practice shells.

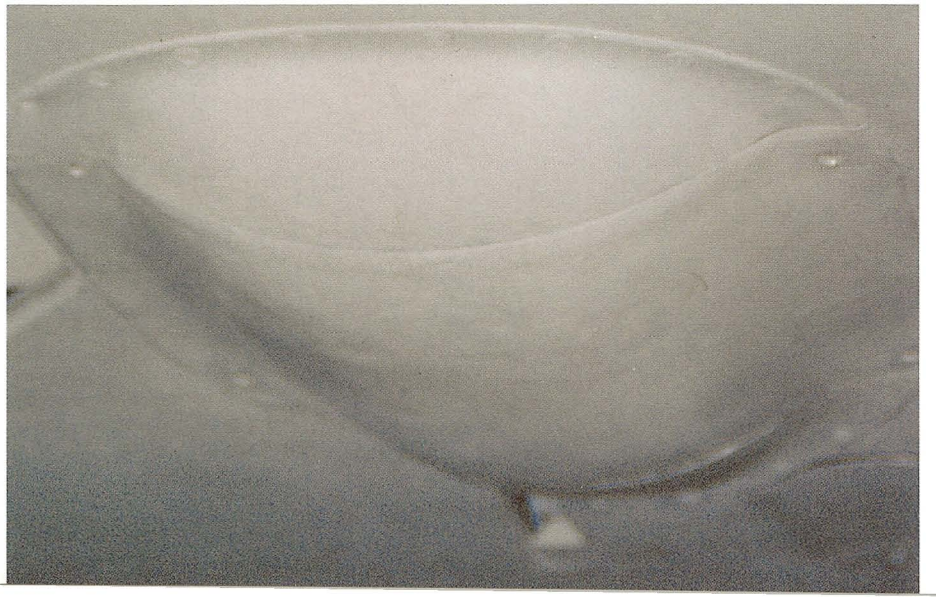
A streamlined blister enclosed the 60-round 20MM T-60 FF ammunition magazine in the lower wing. This feature was used on the Bf 109E-3 and later *Emils*. Flush rivets fastened the blister to the wing surface. The blister's center section was removable for magazine access.

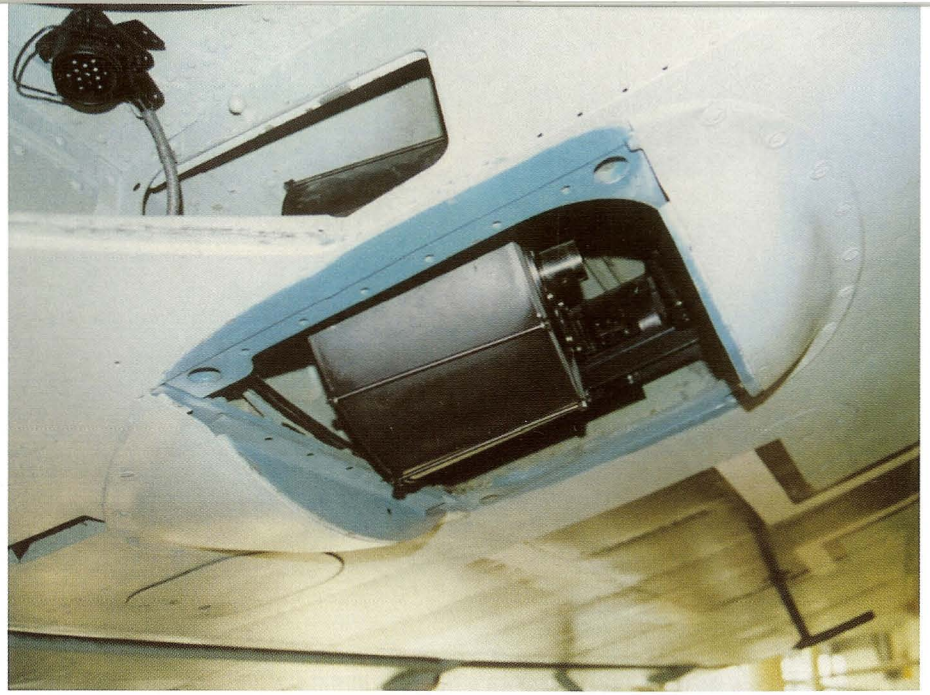




The 20MM MG FF was installed just outboard of the 7.92MM MG 17's position on the Bf 109E-3's wing. The cannon's barrel protruded from the wing leading edge; the MG 17 barrel was flush with the leading edge. This was due to the larger size of the cannon and its ammunition system. A circular plate appears over the MG 17 aperture on the wing leading edge. The leading edge panel around the MG FF's barrel was removed for the weapon's maintenance.

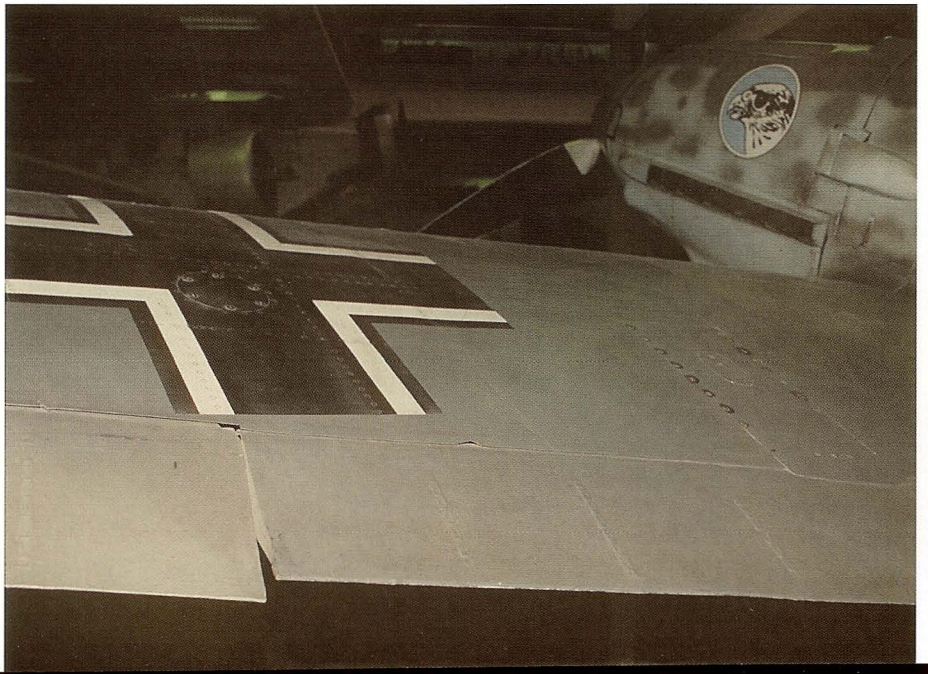
The Bf 109E-3 replaced the E-1's wing-mounted 7.92MM Rheinmetall-Borsig MG 17 machine gun with the 20MM Rheinmetall-Borsig MG FF cannon. The MG FF employed electro-pneumatic charging and operation. A blister fitted to the wing undersurface accommodated the MG FF's T-60 FF magazine. Spent shell cases were collected in a leather-lined wing compartment outboard of the cannon.

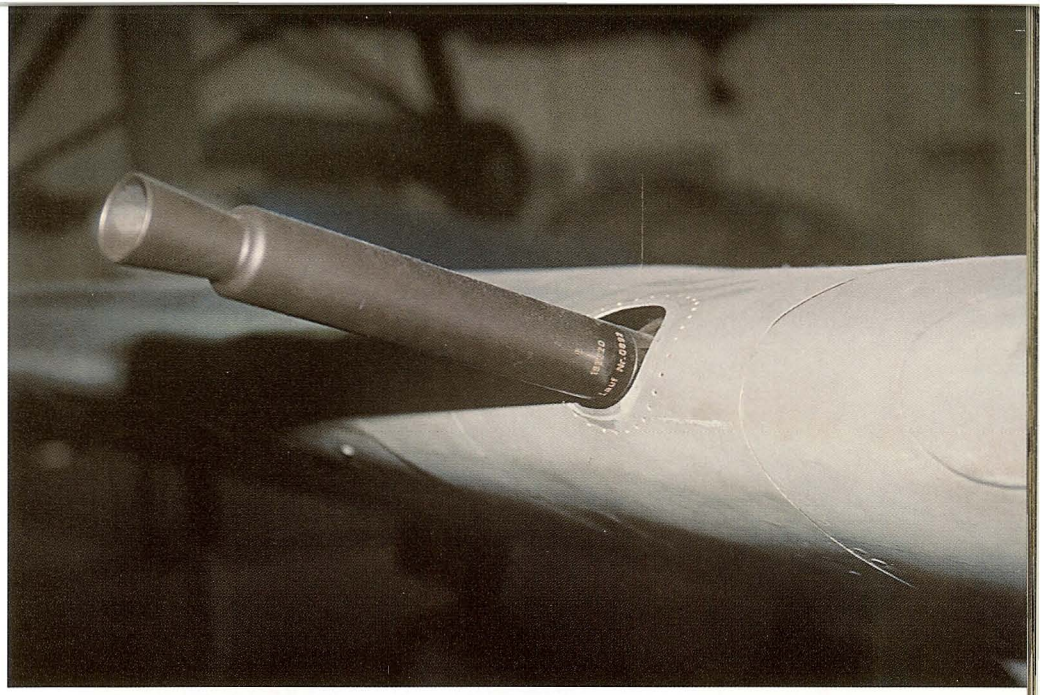




The opened blister fairing reveals the 60-round T-60 FF ammunition drum for the wing-mounted 20MM MG FF cannon. The drum is clipped to the cannon's breech mechanism. Accommodation for this magazine resulted in the wing undersurface bulges on the Bf 109E-3 and later *Emils*. The darker shade of Light Blue paint on the blister's perimeter was due to lesser weathering where this panel was covered. (Jozef And´al)

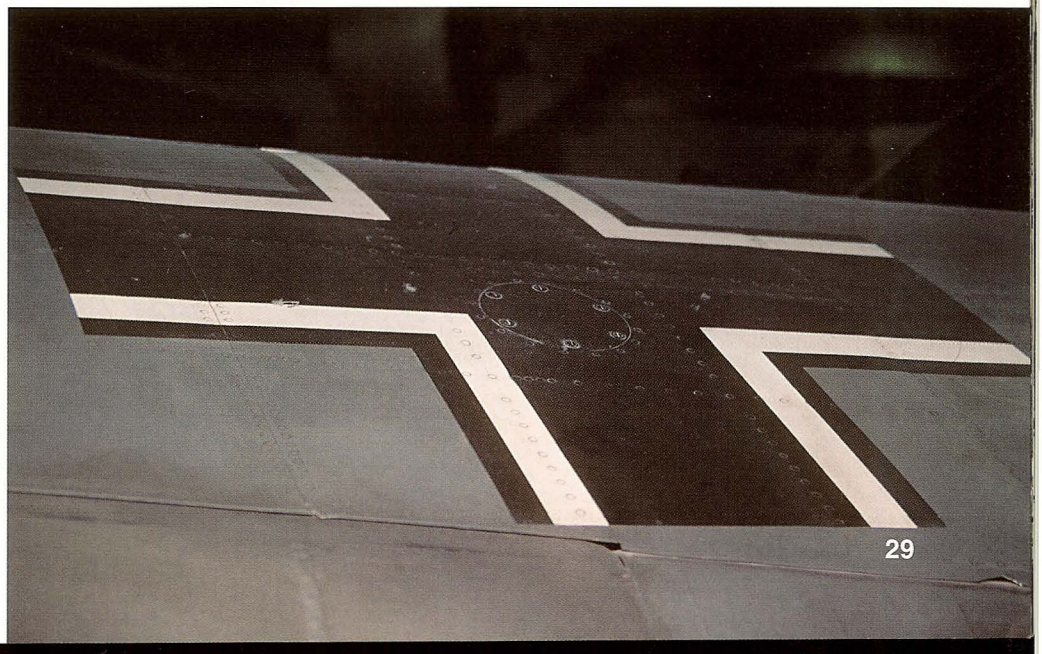
The port aileron is slightly drooped on the *Deutsches Museum*'s Bf 109E-3. This was standard when the aircraft rested on the ground. The rectangular panel immediately forward of the flap provided access to the wing-mounted MG FF cannon breech.





The 20MM MG FF cannon barrel was 800MM (31.5 inches) long – equivalent to 40 calibers – and had a narrow conical flash hider on the muzzle. This flash hider was smaller than the one employed on Swiss-built MG FFs. Each German-built MG FF weighed 30 KG (66 pounds).

Luftwaffe aircraft upper wings were marked with this type of *Balkenkreuz* from early 1940. This replaced the large upper fuselage insignia employed from October of 1939, which were intended to improve German recognition of friendly aircraft. A circular access panel for inspecting control cables and wiring is located in the center of the upper wing *Balkenkreuz*.



Two armorers reinstall the 20MM MG FF into the port wing of a Bf 109E in North Africa. All *Emil* weapons were cleaned during maintenance to remove ammunition residue, dust, and sand that degraded the gun's performance. A coiled spring associated with the recoil mechanism was mounted around the aft barrel section. (Smithsonian Institution)

Luftwaffe mechanics service a Bf 109E-7 (Yellow 2) on a frontline airfield. A 300 L (79 gallon) jettisonable fuel tank is mounted on the centerline. Two bars fitted to the front canopy frame's upper section were typical on Bf 109E-4s and E-7s. These bars were not mounted on earlier *Emils*. The insignia painted under the windshield is of 1. (*Einsatz*; Operational) EJG 3 (*Ergänzungs-Jagdgeschwader*; Fighter Replacement Training Wing). (Manfred Griehl)

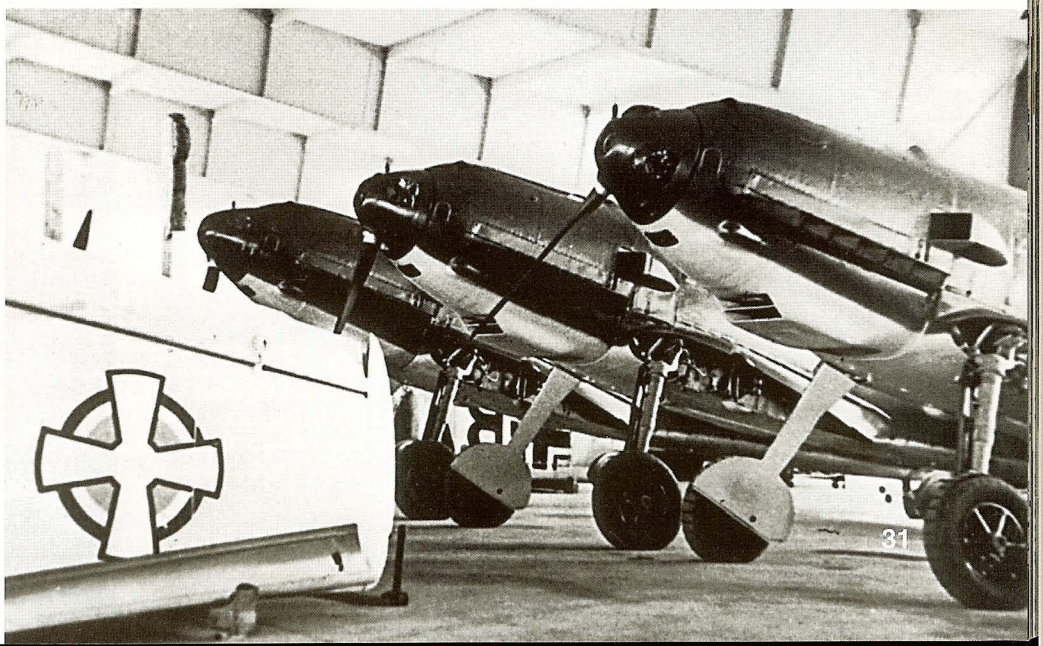
This Bf 109E-1 suffered a landing gear collapse during a hard landing. The wing-mounted 7.92MM MG 17 machine guns were deleted and their apertures faired over on this aircraft. The propeller blades' condition indicated the engine had stopped running when the gear collapsed. (Manfred Griehl)

Vzdusne zbrane (Vz; Slovak Air Arm) pilots (from left) Rudolf Bozik, Frantisek Brezina, and Karol Geletko walk away from a *Letka* 13 (13th Squadron) Bf 109E-3 in 1944. Both Bozik and Brezina wear the Iron Cross bestowed by Germany. All three pilots were assigned to *Letka* 13 at Piestany, Slovakia. (Ivo Zetik)

Test pilot Sylvester Wanneck supervises an engine test on a newly-built Bf 109E-4/B at *Wiener Neustädter Flugzeugwerke* (WNF) at Wiener Neustadt, Austria. The number 86 in White on the engine cowling indicated this was the 86th Bf 109 assembled by this plant. Protective covers were placed over the 20MM cannon muzzles. Engine oil leaked from the lower fuselage and onto the main landing gear doors. (Manfred Griehl)

French civilian mechanics dismantle a Bf 109E damaged during the Battle of Britain. The Bf 109E's main landing gear was mounted to the fuselage. This eased both assembly and wing removal for ground transport; however, the fuselage-mounted landing gear reduced its track, which made the *Emil* difficult to taxi, take off, and land. (Smithsonian Institution)

Bf 109E wings were easily removed from the fuselage for road transport. Three Bf 109E-3s built for Yugoslavia await delivery at Messerschmitt's Regensburg factory. Yugoslav *Emils* had RLM 70 Black Green upper surfaces over RLM 65 Light Blue under-surfaces. *Kosovski krizevi* (Kosovo Crosses) only appeared on the upper and lower wings. The main landing gear was attached to the Bf 109E's fuselage. (Heinz J. Nowarra)

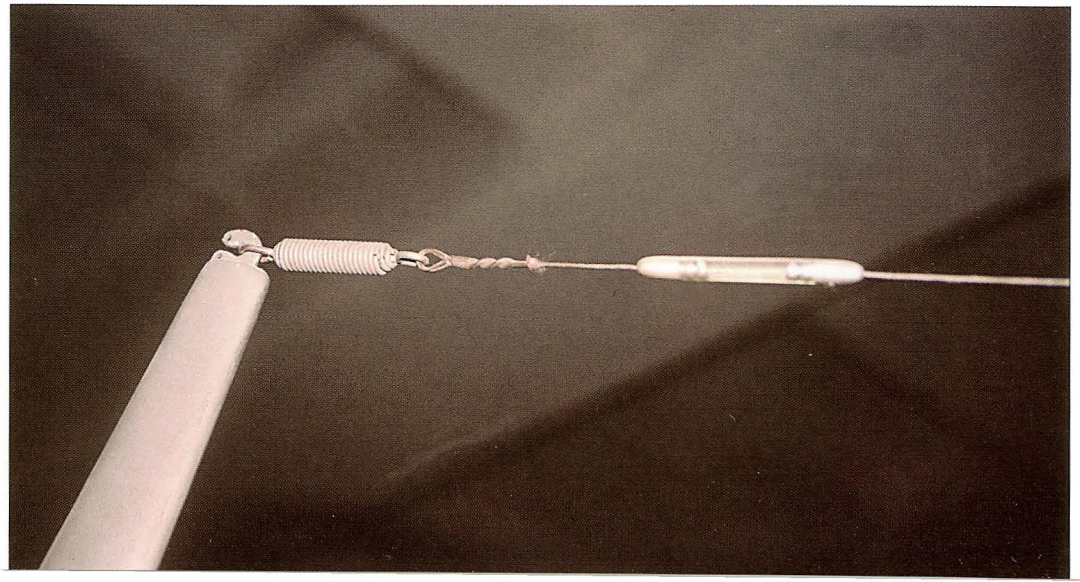


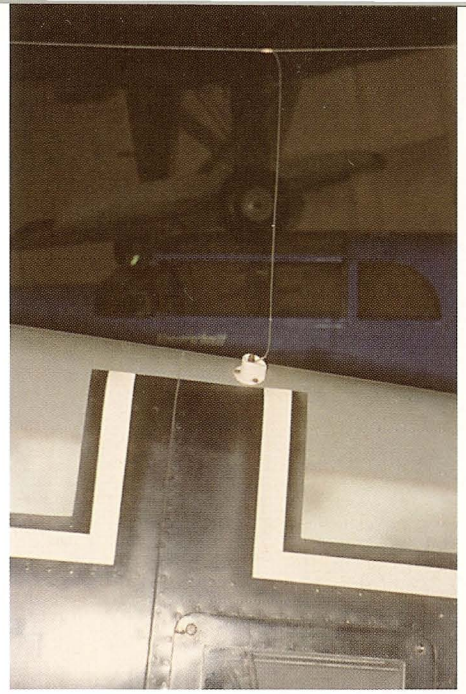
The Black and White *Geschwader Kommodore*'s markings are painted on the Bf 109E-3 exhibited at the *Deutsches Museum* (German Museum) in Munich. The handhold above the chevron and the footstep below it both have spring-loaded doors flush with the fuselage skin. Both doors are made of light sheet alloy. The RLM 04 Yellow and RLM 22 White triangle on the upper fuselage indicated the fueling point.

The Black number 87 within the Yellow triangle indicated the aviation gasoline octane rating necessary for the DB 601A engine. The filler cap for the 400 L (106 gallon) fuel tank is located immediately above this triangle marking. Both the cap and fuel marking were only on the Bf 109E-3's port side.

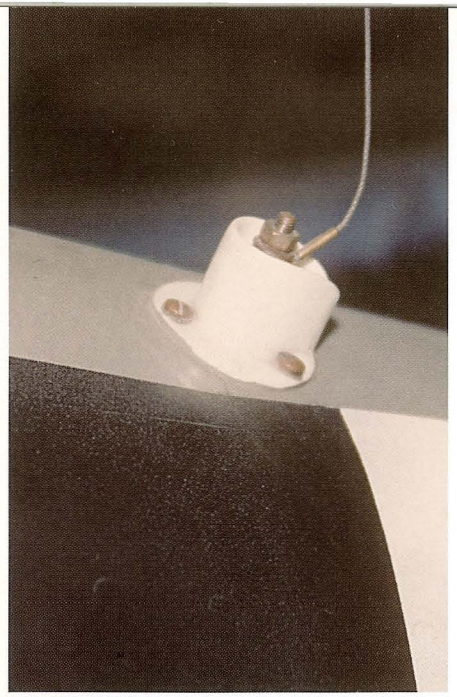
A Black semicircle is painted above the footstep on the port lower fuselage. *Einstiegklappe* (Stepboard) was usually painted above this step, but was not on this Bf 109E-3. A spring-loaded cover plate was located over the footstep. The wing root fairing was located forward of this step.

This antenna cable's forward attachment point is atop the antenna mast; however, it is inaccurate for a Bf 109E. Operational *Emils* actually had Bakelite plastic insulators just aft of the mast attachment point. The Bf 109E-3 displayed at the Swiss Air Force Museum at Dübendorf has the accurate operational antenna arrangement.



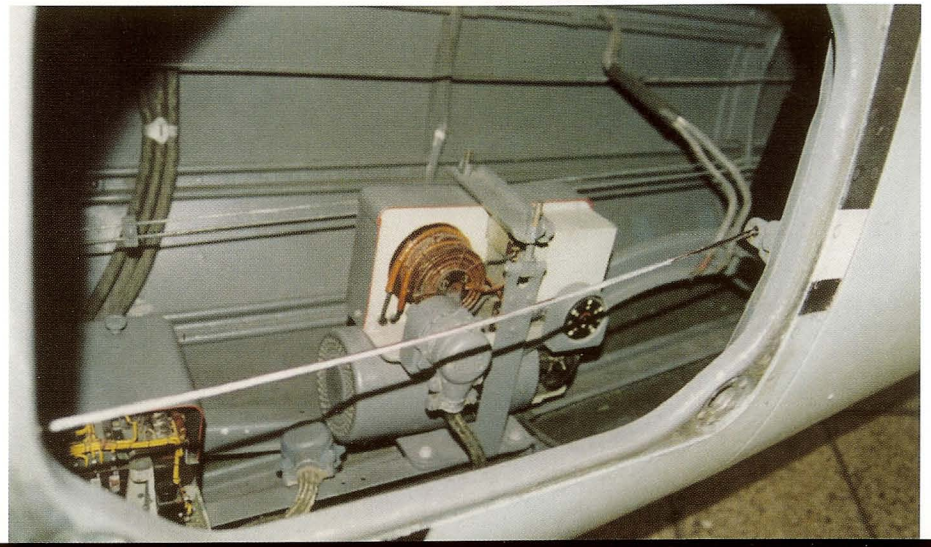


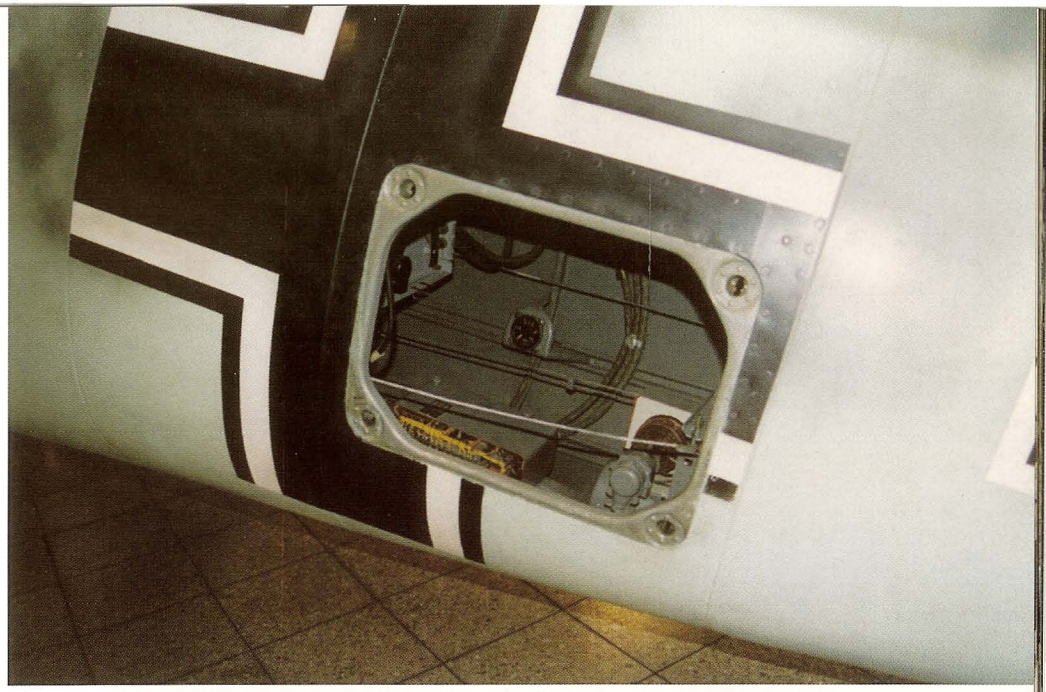
The antenna lead-in cable is connected between the main antenna cable and the aft fuselage. This cable ran down the fuselage into the Telefunken FuG VII (7) radio, which is installed within the fuselage. The access panel for both the radio and the first aid kit has been removed from the port fuselage side.



The lead-in cable was attached to the upper fuselage slightly offset to port. It enters the fuselage through a White plastic insulator, which was fastened to the skin with bolts. This cable led from the radio inside the fuselage, through this attachment point, to the main antenna cable running from the antenna mast to the vertical tail.

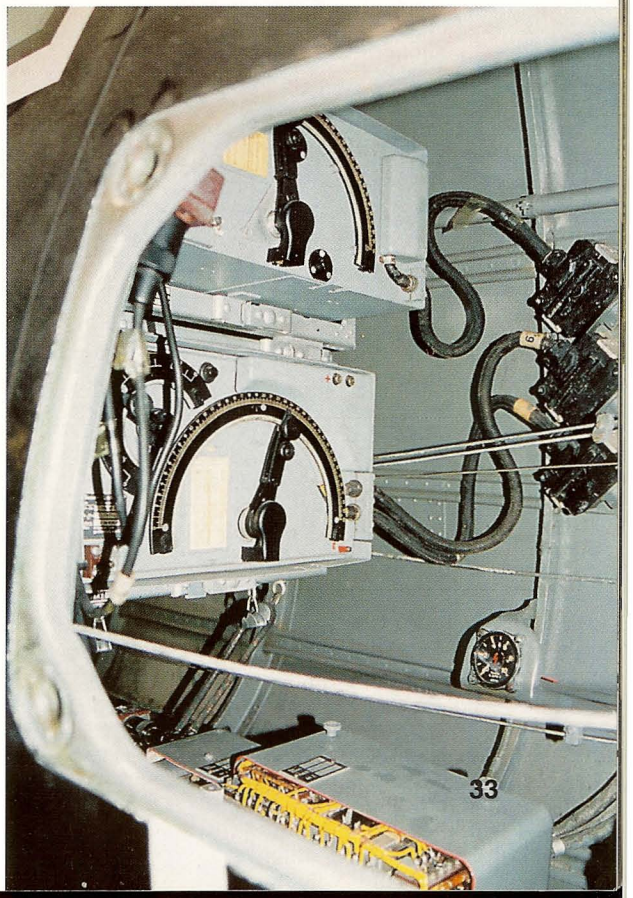
A battery (also called an accumulator) mounted on the aft fuselage floor supplied electrical power to the radio. Rudder control cables run low along the aft fuselage sides, while cables for the elevators and for the horizontal stabilizer incidence adjustor ran higher along the sides. Bf 109E interiors were usually painted RLM 02 RLM Gray. (Jozef And´al)

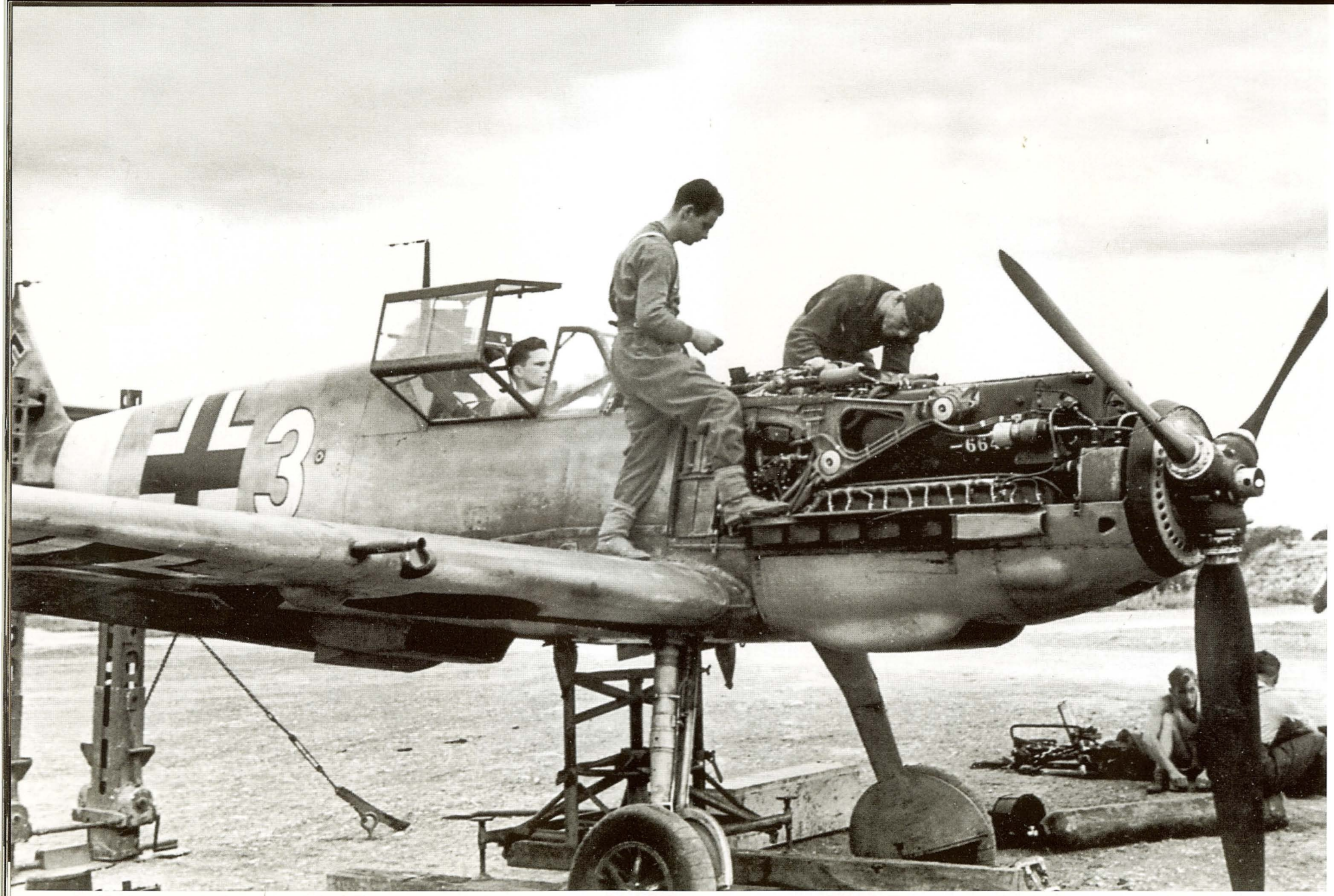




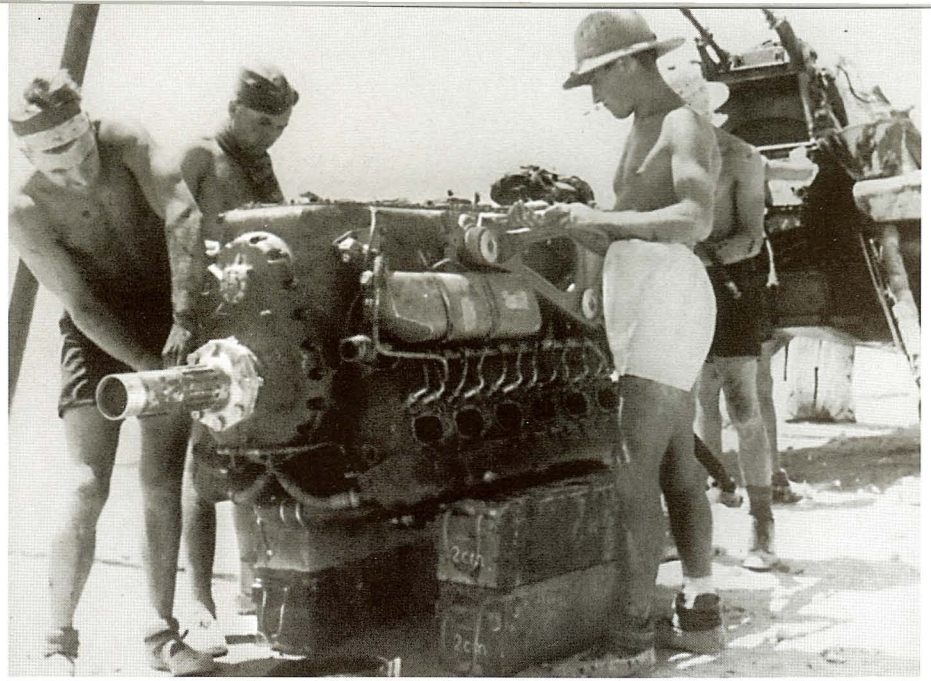
(Above) The port rear fuselage access hatch is removed from the *Deutsches Museum*'s Bf 109E-3. Four flush-mounted screws secured this hatch to the fuselage. A first-aid kit was placed in this compartment in case the pilot crash-landed and needed medical help. This hatch also provided access to the FuG VII radio and the control cables. (Jozef And´al)

(Right) The FuG VII radio is mounted inside the aft fuselage, forward of the access panel opening. This set – consisting of a receiver (top) and a transmitter – was placed on anti-vibration mountings fitted into the fuselage. Three black junction boxes are mounted on the starboard side. Electrical leads mounted on the fuselage floor transferred power from the battery to the FuG VII and other electrical systems on the aircraft. (Jozef And´al)

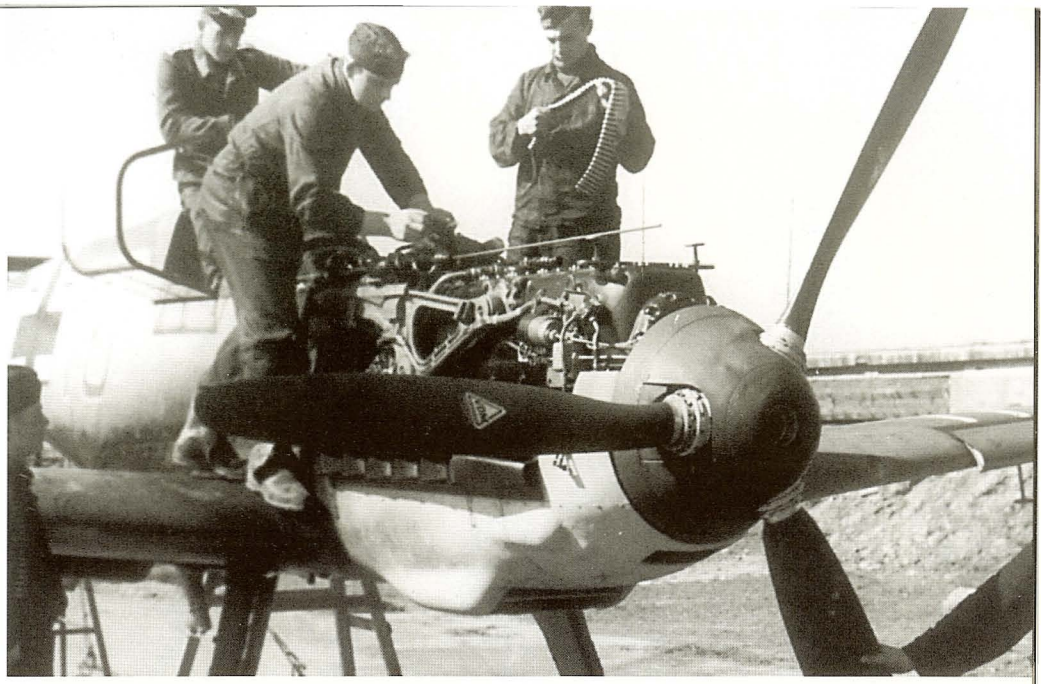




JG 27 personnel have jacked up a Bf 109E-7/*Trop* (White 3) for firing trials in the North African desert. The propeller spinner and upper cowling panels were removed for maintenance. One of the technicians is adjusting the two 7.92MM Rheinmetall-Borsig MG 17 machine guns on the upper fuselage. These weapons and their synchronization gear had to be reconnected after they and the engine were serviced. An enlarged drop-shaped blister is located below the air intake tunnel. A non-standard inlet is placed immediately aft of the propeller. For an unknown reason, the circular aperture for the MG 17 was not covered on the wing leading edge, inboard of the 20MM Rheinmetall MG FF cannon. (*Deutsches Museum*)



Luftwaffe mechanics service a DB 601A engine in North Africa. This powerplant was removed from a Bf 109E in the background and mounted on 2 CM (20MM) cannon ammunition boxes for an improvised stand. The DB 601A's hollow propeller shaft enabled a 20MM MG FF cannon to be fired through it, however, no *Emil* was armed with such a weapon. (Smithsonian Institution)



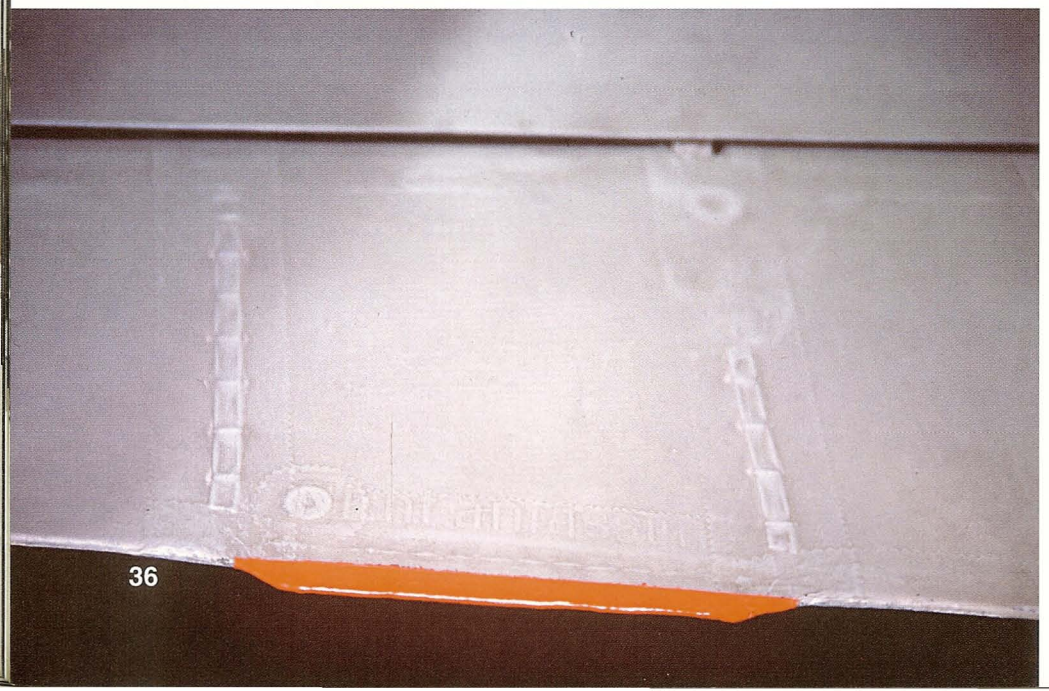
Armorers load 7.92MM ammunition to this Bf 109E-1's fuselage-mounted MG 17s. Each fuselage-mounted MG 17 was supplied with 1000 rounds of ammunition. VDM emblems placed on each propeller blade identified the propeller's manufacturer. (Smithsonian Institution)

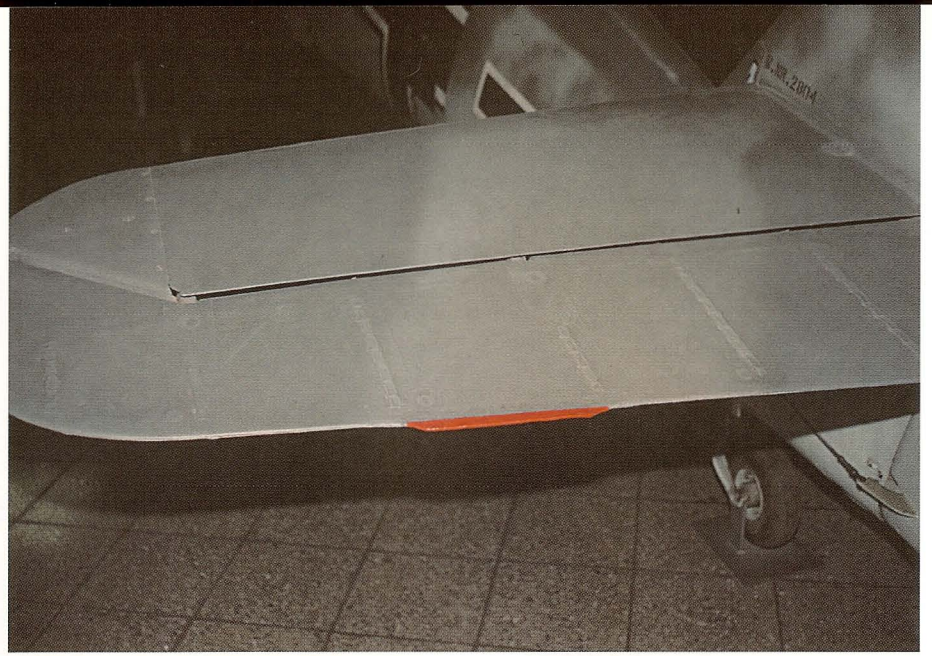
A JG 27 Bf 109E-4/*Trop* rests between missions at an air base in Libya. A 300 L external fuel tank mounted on the centerline pylon is stained by leaked engine oil. Main landing gear tire outer surfaces were painted White on North Africa-based *Emils*. This paint reduced the intense desert heat, which dried out the rubber. This Bf 109E-4/*Trop* is finished in the North African scheme of RLM 79 *Sandgelb* (Sand Yellow; FS30215) and RLM 80 *Olivgrün* (Olive Green; FS34052) upper surfaces over RLM 78 *Hellblau* (Light Blue; FS35414).

Two Luftwaffe mechanics service the fuselage-mounted 7.92MM MG 17s of a Bf 109E-7/*Trop* (Black 10) at its airfield in North Africa. This fighter is believed to be assigned to 10(*Jabo*)./JG 27, a *Jagdbomber* (Fighter-Bomber) squadron. Fine desert sand increased the maintenance burden on both Axis and Allied aircraft in North Africa. The open canopy has the armor plate mounted at its rear for pilot protection. This Bf 109E-7/*Trop*'s upper surfaces appear to be RLM 79 Sand Yellow and RLM 80 Olive Green, while undersurfaces were RLM 78 Light Blue. The propeller spinner, lower cowling, and aft fuselage band are RLM 21 White. (*Bundesarchiv*)

The *Deutsches Museum*'s Bf 109E-3 lacks the *Hakenkreuz* (swastika) on the vertical stabilizer. This is common on Luftwaffe aircraft displayed in the Federal Republic of Germany, which bars public displays of the swastika. The Spanish painted a swastika on this *Emil* prior to donating it to the *Deutsches Museum*, but museum officials quickly overpainted it prior to placing the aircraft on display.

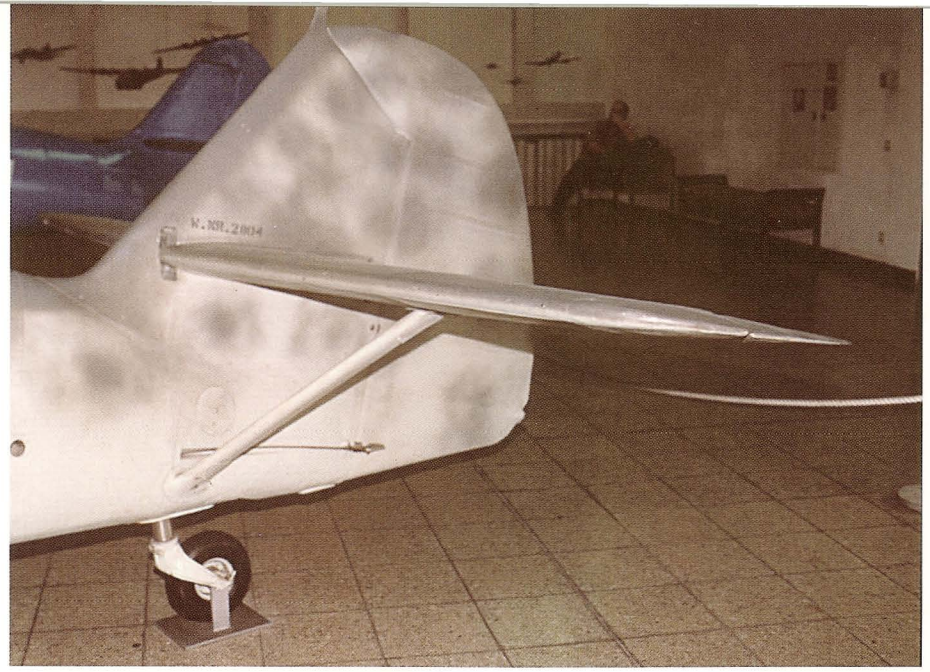
A fixed trim tab is mounted on both the port and starboard elevators. This tab held the elevator in the desired neutral position in flight. Luftwaffe tabs were painted RLM 23 Red (FS31140) on both upper and lower surfaces. Some Bf 109Es had a broken Red line painted ahead of the trim tab, but this is not the case on this aircraft.





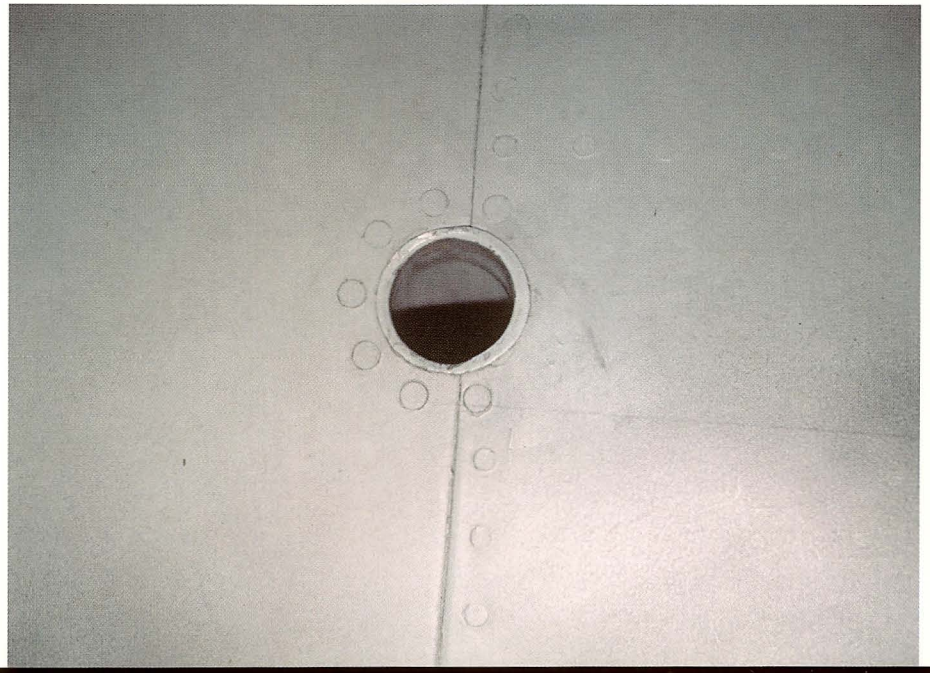
The elevators were fabric-covered metal structures, while the horizontal stabilizers (also called tailplanes) had metal skinning and structure. Both port and starboard elevators moved in unison in a range of +33° to -34°. A circular plate is mounted where the elevator bolts were attached to the horizontal stabilizer.

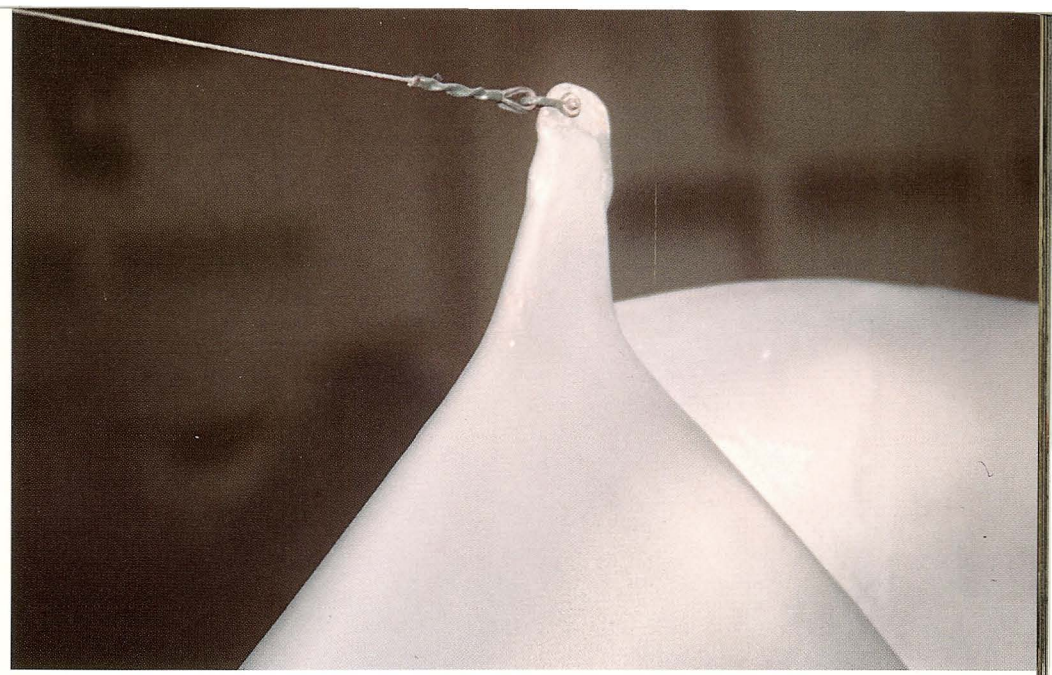
The *Deutsches Museum*'s Bf 109E-3 is painted as Luftwaffe ace Werner Mölders' aircraft, but lacks the kill markings that he painted on the rudder. Inboard elevator surfaces ended at a sharp angle to allow full rudder movement. The Red trim tab protrudes from the starboard elevator's trailing edge.



A single strut mounted on the lower aft fuselage supported each Bf 109E horizontal stabilizer. This feature was a holdover from previous Bf 109 variants. The rudder control cable exited the fuselage to a horn on the lower rudder. Maximum Bf 109E rudder movement was 34˚ to both port and starboard.

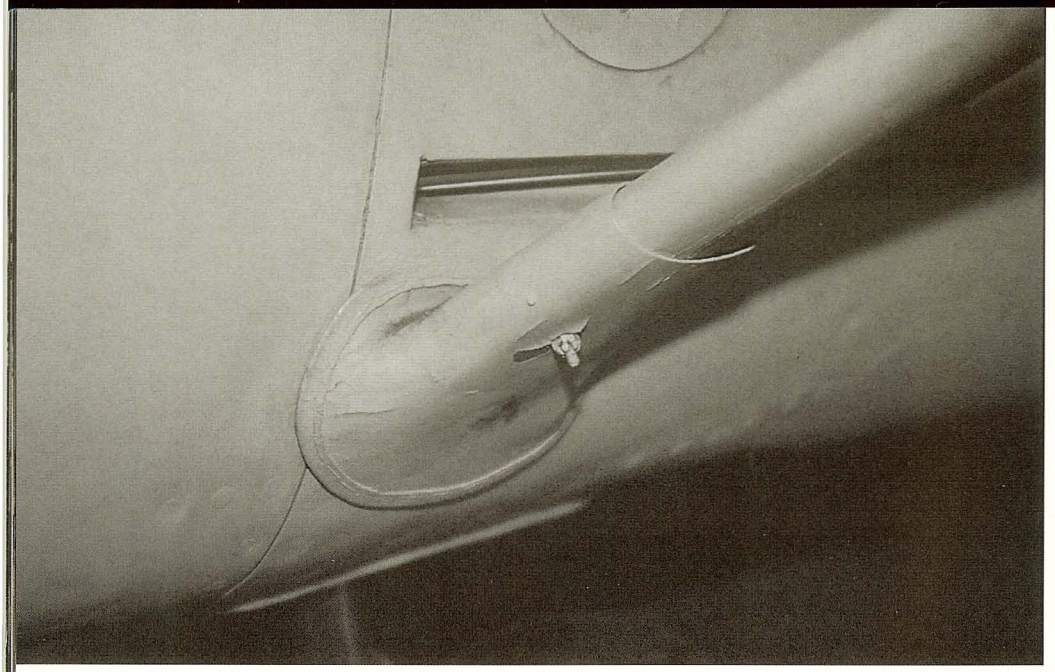
A lifting bar insertion hole is mounted in the aft fuselage on both port and starboard sides. Mechanics placed the bar inside this hole when they raised the aircraft off its tail wheel into a vertical position. This measure was primarily done for inspecting the aircraft or for testing the armament after maintenance.





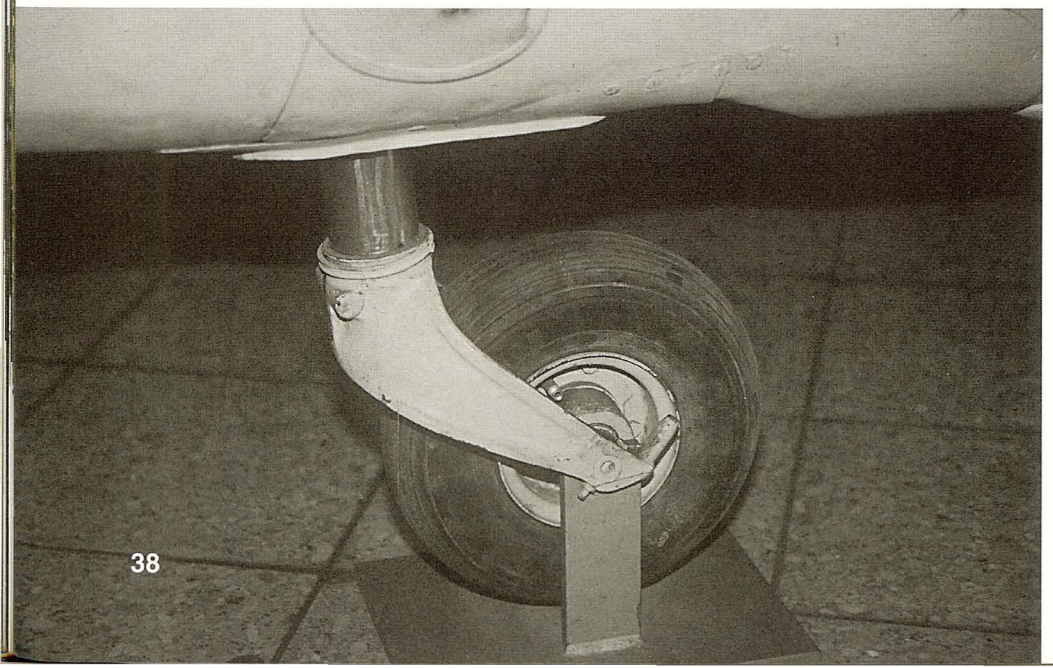
The vertical fin tip incorporated a short radio antenna mast. The aft end of the antenna cable that ran from the mid-fuselage mast was secured to this tail mast. The *Deutsches Museum*'s *Emil* lacks the conical plastic insulator and metal spring found on original Bf 109E antenna cables. An accurate rear antenna cable layout is seen on the Swiss Air Force Museum's Bf 109E-3.

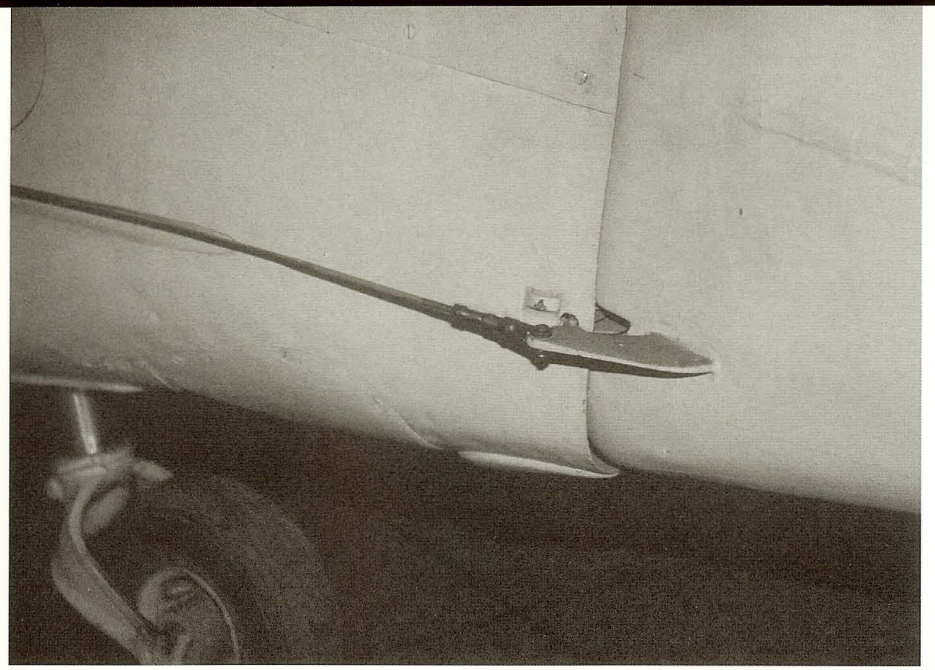
The vertical stabilizers (tailplane) were adjusted through this mechanism located on the vertical stabilizer. The pilot adjusted the tailplane angle from +3˚ to -8˚ using a wheel mounted on the port cockpit wall. Raising or lowering the tailplane angle adjusted the aircraft's trim in flight when its weight changed. The *Deutsches Museum*'s Bf 109E-3 has the fictional *Werk Nummer* (W. Nr.) 2804 painted on the tail; this *Emil*'s actual *Werk Nummer* was 790.



The tailplane support strut was mounted to the lower aft fuselage through a streamlined fairing. Immediately above the strut fairing, the rudder control cable protrudes from the airframe. The *Emil* was the last Bf 109 variant equipped with tailplane support struts; these were deleted on the Bf 109F and later variants.

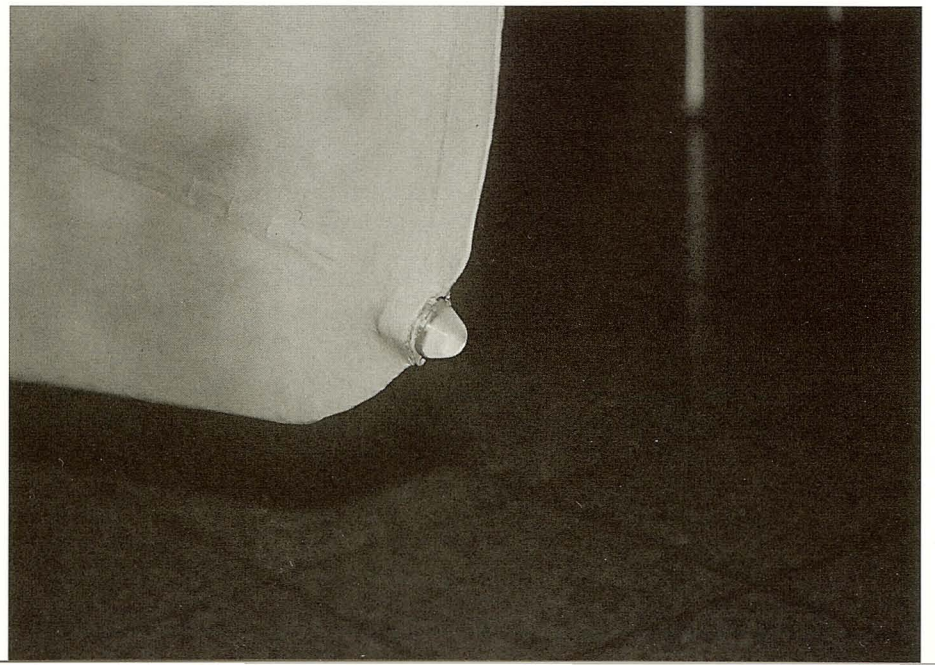
Bf 109E-3s and other *Emils* each had a fixed single tail wheel located 15° to the vertical line. The tail wheel tire was 290MM (11.4 inches) in diameter and 110MM (4.3 inches) in width. A leather sleeve was normally placed over the oleo (shock absorbing) strut above the wheel on operational *Emils*. The *Deutsches Museum* raised the tail wheel on a plinth to reduce stress on this item.





The protruding rudder cable was a typical Bf 109E feature. These cables ran down the port and starboard sides from the rudder pedals to the lower rudder. The Bf 109F and later variants had these cables completely enclosed within the airframe.

A clear (white) position light is mounted on the Bf 109E-3's rudder. This light operated in conjunction with the red (port) and green (starboard) wingtip position lights during night flights. These lights were seldom used, since *Emils* rarely flew at night.

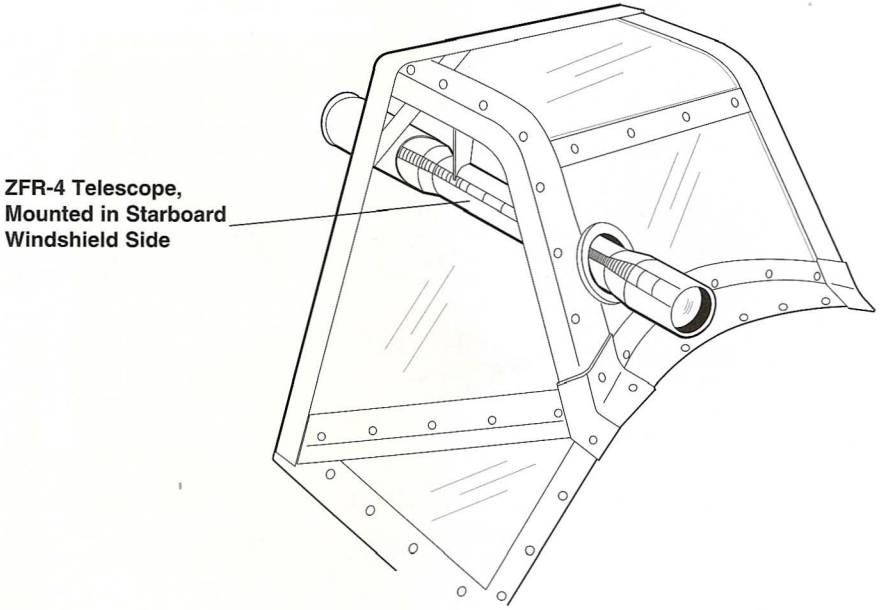


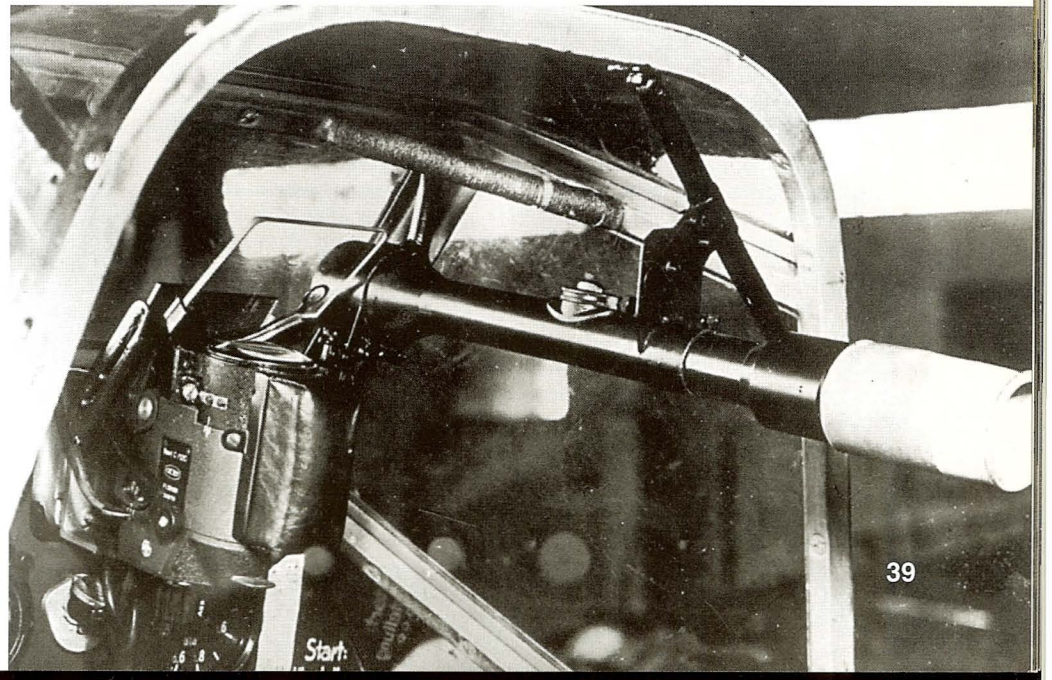
A ground crewman poses by the tail of Major Adolf Galland's Bf 109E-4/N (*Werk Nummer* 5819) in early 1941. Galland led III. *Gruppe* of JG 26 *'Schlageter'* during the Battle of Britain. His 'Mickey Mouse' insignia is painted under the cockpit, while the White-trimmed Black *Gruppen Kommodore*'s chevrons are painted ahead of the *Balkenkreuz*. Numerous Black victory bars are painted on the RLM 04 Yellow rudder. (Griehl)

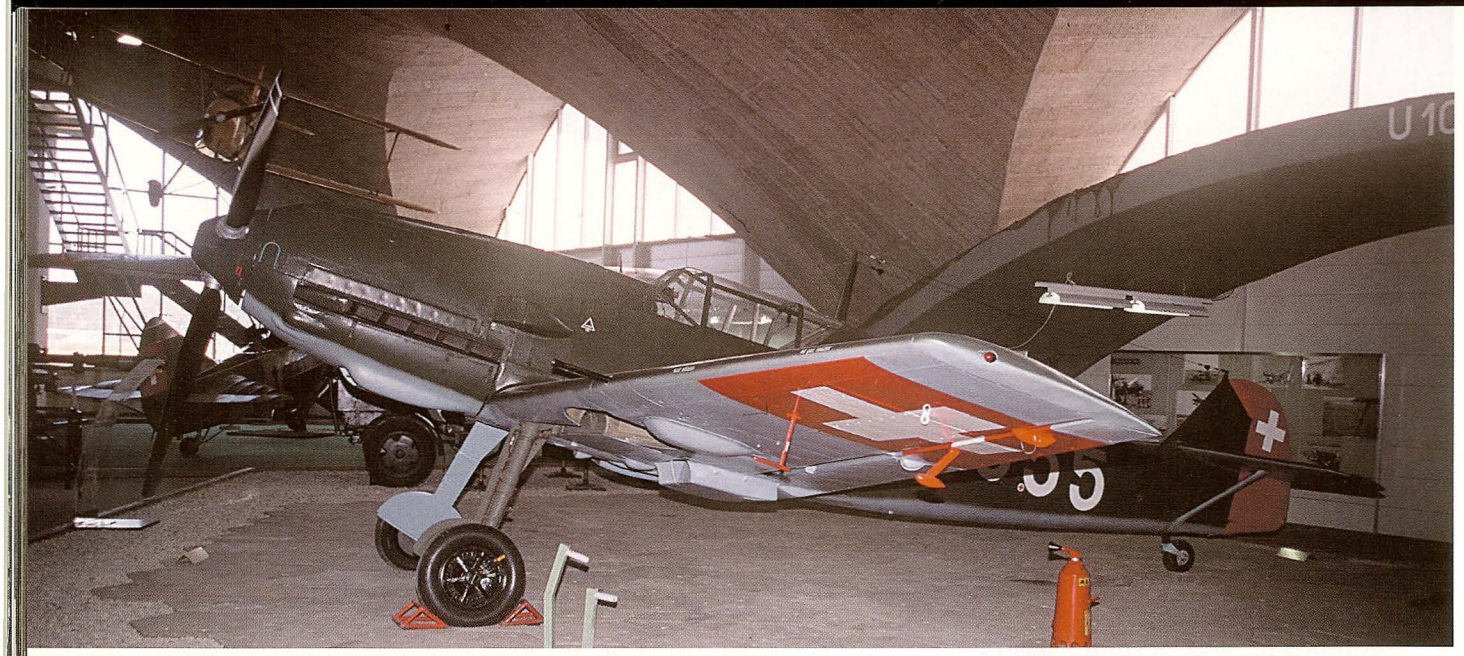
Major Galland sits in his Bf 109E-4/N (*Werk Nummer* 5819) in late 1940. His *Emil* is equipped with the ZFR-4 telescope. This device was only used to detect enemy aircraft at a distance, not as a gun sight. Only a few Bf 109Es received the ZFR-4. JG 26's insignia – a Black S on a White shield – is painted on the forward fuselage. Galland scored 104 victories by the end of World War Two. (Manfred Griehl)

The ZFR-4 telescope was mounted on the windshield's starboard side. The Revi C/12D sight mounted atop the instrument panel was employed for aiming the Bf 109E's weapons. (*Deutsches Museum*)

Windshield of Adolf Galland's Bf 109E-4







This Bf 109E-3 (J-355; *Werk Nummer*/Factory Number 2422) is exhibited at the Swiss Air Force Museum at Dübendorf Air Base near Zürich, Switzerland. This *Emil* was carefully restored and painted in the camouflage and markings it wore between January and April of 1940. This is by far the most accurate Bf 109E-3 existing in the world; however, this *Emil* had features that were typical for *Schweizer Fliegertruppe* (Swiss Air Force) Bf 109Es. Swiss fighters had fuselage codes that began with J (*Jagd*; Fighter). Switzerland's *Fliegertruppe* was renamed the *Flugwaffe* in 1946. (Walter Hodel)

Swiss Air Force Museum Bf 109E-3

The *Schweizer Fliegertruppe* (Swiss Air Force) was the first and largest Bf 109E export customer. The Germans delivered 80 Bf 109E-3s from the Messerschmitt factory at Regensburg, Germany to Switzerland between 7 May 1939 and 27 April 1940.

The Swiss purchased their *Emils* without armament and radios. Machine gun apertures in the upper engine cowling were faired over for the ferry flight to Switzerland. The aircraft delivered to Switzerland were technically nearly equal to the Luftwaffe's Bf 109E-3.

The main difference between Swiss and German Bf 109E-3s was the armament. Luftwaffe *Emils* were armed with two 20MM Oerlikon MG FF cannon in the wings. This Swiss-designed weapon was manufactured under license by Rheinmetall-Borsig AG in Düsseldorf, Germany and had electro-pneumatic ammunition loading. The *Schweizer Fliegertruppe* used the 20MM FF-K Oe 37 (*Flugzeugflügel-Kanone Oerlikon 1937*; Wing-Mounted Cannon Oerlikon 1937). This weapon – built by Werkzeugmaschinenfabrik Oerlikon at Zürich, Switzerland – could only be manually loaded on the ground. This modification resulted in several pressurized air pipes fitted to German Bf 109E-3s being deleted on Swiss aircraft. While the German MG FF had a conical flash hider, the Swiss FF-K employed a funnel-type flash hider.

The German *Emil*'s fuselage armament consisted of two 7.92MM Rheinmetall-Borsig MG 17 machine guns mounted in stagger on the upper cowling. The Swiss aircraft replaced these weapons with two Swiss-built 7.45MM *Eidgenössische Waffenfabrik* (EW; Federal Arms Factory) MG 29 machine guns mounted side-by-side. This change in weapons resulted in deletion of the two drop-shaped blisters found on the upper engine cowling of German Bf 109E-3s. Additionally, both MG 29s were mounted 4 CM (1.6 inches) wider from each other than the MG 17s mounted on the German Bf 109E. The Swiss Bf 109E-3s had these blisters replaced by two small rectangular-shaped blisters just in front of the canopy frame. A few Swiss *Emils* had two circular blisters located just below the ventilation slots. Apart from these modifications, Swiss Bf 109E-3s employed the standard German engine cowling.

The fuselage-mounted machine guns were loaded and fired electro-pneumatically on German Bf 109E-3, but manually with control cables on the Swiss *Emil*. This resulted in the *Fliegertruppe*'s *Emils* lacking the four compressed air bottles installed on German aircraft. The staggered mounting of the MG 17s meant that only the port gun's muzzle was visible; both muzzles were visible on the side-by-side mounted Swiss guns. The MG 29 – assembled in Berne – used a cylindrical muzzle, while the German MG 17 featured a conical-shaped muzzle.

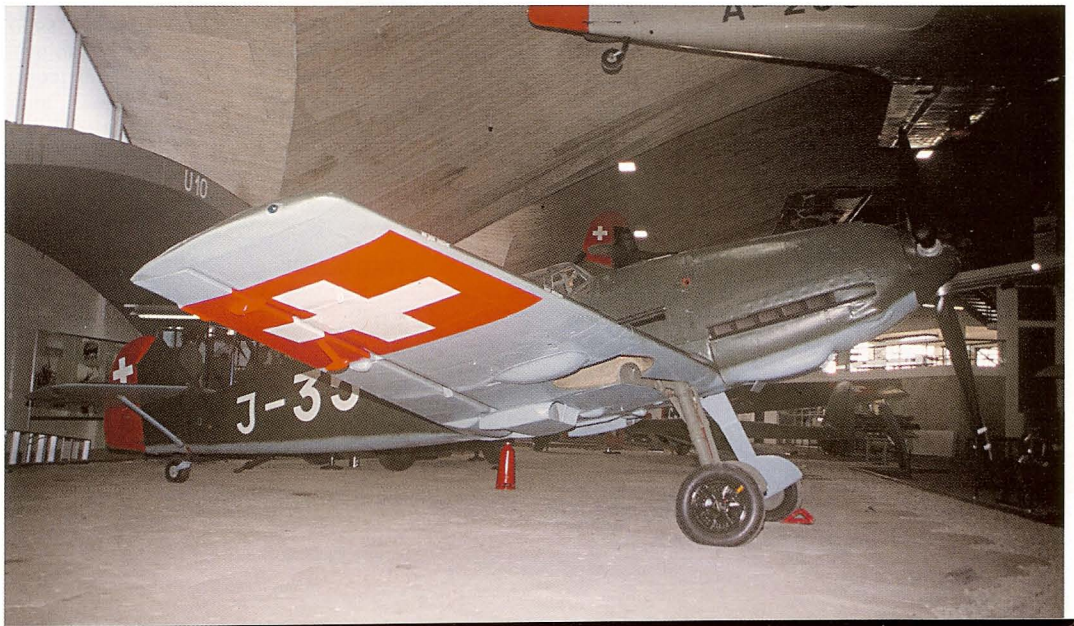
Luftwaffe Bf 109Es had two 1000-round magazines for the MG 17s located on the starboard engine compartment. The Swiss *Emils* replaced these magazines with a single 960-round magazine for both guns. This total was 1040 rounds less than for the German Messerschmitt with a heavier caliber machine gun.

French-built SIF 450 radios were located immediately aft of the fuel tank between frames 5 and 6 on some Swiss Bf 109E-3s. This replaced the aft-fuselage Telefunken FuG VII (7) on German Bf 109E-3s. Swiss *Emils* had the Bakelite (plastic) fuselage antenna cable fairing mounted 18 CM (7.1 inches) forward of the original German position. This was due to the different radio equipment positions on German and Swiss aircraft. Other *Fliegertruppe Emils* lacked radios. Sometime in 1941, Swiss *Emils* were modified with an outlet on the starboard fuselage immediately aft of the rear cockpit glazing. This vented gases generated by batteries mounted in the rear fuselage.

This Messerschmitt Bf 109E-3 (J-355; *Werk Nummer*/Factory Number 2422) is the only surviving Swiss *Emil*. (The J code number prefix stands for *Jagd*, Fighter.) It was flown from Regensburg to Switzerland on 30 October 1939 and was accepted by the *Fliegertruppe* on 7 November 1939. During its nearly ten year long operational service, J-355 flew a total of 323 flying hours and was powered by four different DB 601 engines. It last saw service during exercises with *Flieger Kompagnie* 8 (8th Flying Company) between 12 and 22 September 1949. (A Company was equivalent to a Squadron.) On 28 December 1949, the Swiss Federal Military Department issued an order removing all remaining Bf 109E-3s from service. J-355 was stored at a depot at Ennetbürgen in Central Switzerland before going on display at the Swiss Transport Museum in Lucerne on 30 June 1959. Twenty years later, this Messerschmitt was moved from Lucerne to Dübendorf Air Base near Zürich. It became part of the newly founded Swiss Air Force Museum, where it remains on display.

The Bf 109E-3 (J-355; *Werk Nummer* 2422) is exhibited at Dübendorf with a Swiss 34MM *Flab Kanone 38* (Anti-Aircraft Gun 38) and an EKW C-36 multi purpose aircraft. Roundel-type national markings – a White (FS37886) cross within a Red (FS31140) circle – were painted on the wing upper surfaces. This insignia was used on Swiss *Emils* until Red and White Neutrality Markings were adopted in September of 1944. Roland Küng, a Swiss Air Force employee, extensively researched the correct scheme and markings for this Bf 109E-3. (Walter Hodel)

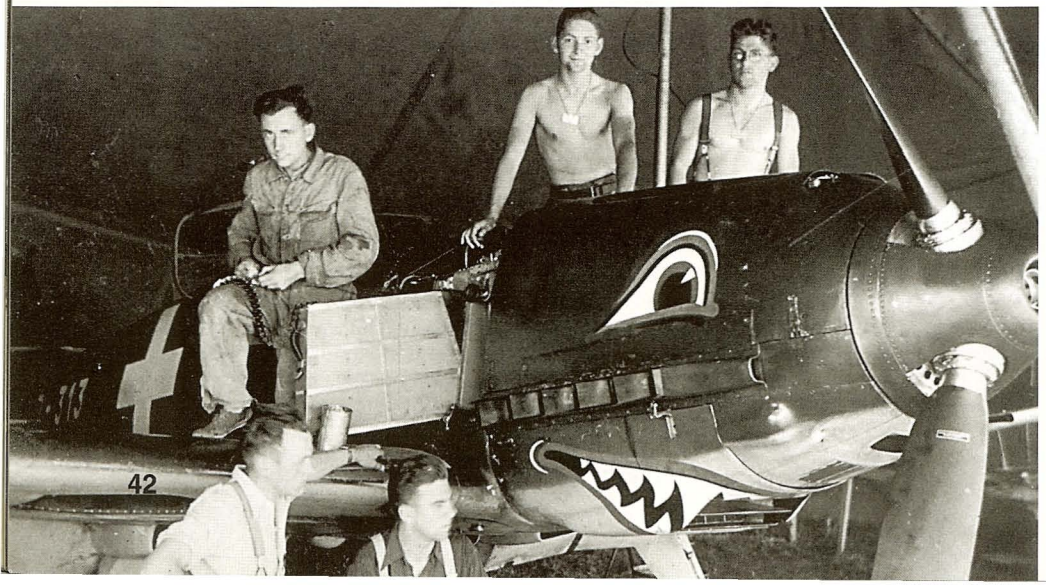
This Bf 109E-3 is painted with the squared national marking that replaced the roundel on *Fliegertruppe* aircraft undersurfaces in January of 1940 This *Emil* was part of the second batch of 50 Bf 109E-3s delivered to Switzerland. Its paint scheme consisted of RLM 70 *Schwarzgrün* (Black Green; FS34050) upper surfaces and RLM 65 *Hellblau* (Light Blue; FS35352) undersurfaces. (Walter Hodel)



The Bf 109E-3 (J-355; *Werk Nummer* 2422) now displayed at Dübendorf rests outside the Messerschmitt factory in Regensburg, Germany in October of 1939. In front of J-355 is another Bf 109E-3 (J-352; *Werk Nummer* 2409) bound for Switzerland. Full national markings and registration numbers were painted on the Swiss *Emils* prior to delivery. Initially, only the upper rudder section was painted in Red, while the lower part remained in RLM 70 Black Green. Swiss *Emils* did not receive temporary German civil registrations for the ferry flight, unlike the Yugoslav Bf 109E-3s also built at Regensburg. The Germans shipped several Bf 109E-3s by rail from Regensburg to Friedrichshafen, which lies beside the Bodensee (Lake Constance) along Germany's border with Switzerland. The Germans reassembled the aircraft at Friedrichshafen and handed them over to the *Schweizer Fliegertruppe*. No armament was mounted into the aircraft in Germany; the machine gun openings on the upper engine cowling were faired over prior to delivery. (Swiss Air Force Museum via Roland Küng)

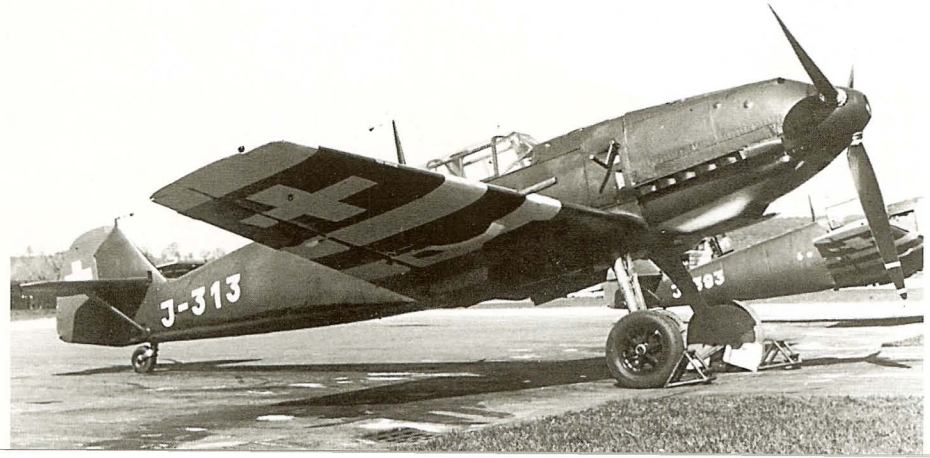
A Bf 109E-3 (J-313; *Werk Nummer* 2161) is parked at Dübendorf, Switzerland after its delivery from Germany in the summer of 1939. This *Emil* was still unarmed, with the fuselage machine gun apertures faired over for its delivery from Germany. The two blisters atop the engine cowling were a typical feature for unarmed Bf 109Es. (Swiss Air Force Museum via Roland Küng)

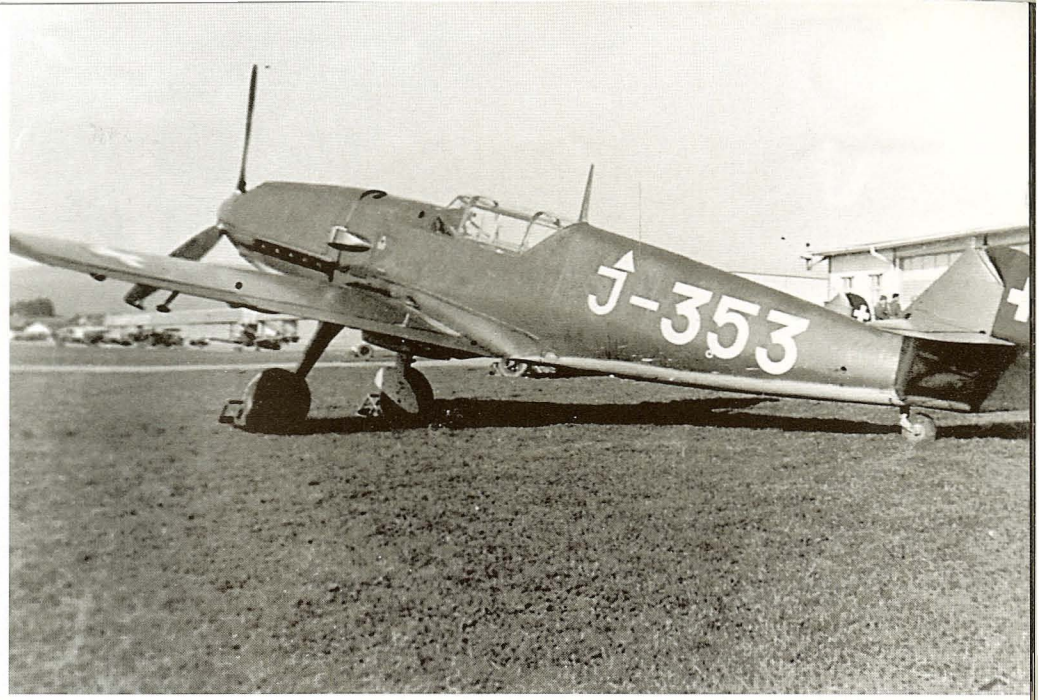
A ground crew services this Bf 109E-3 (J-313; *Werk Nummer* 2161) at Emmen Air Force Base near Lucerne during the early 1940s. A sharkmouth – insignia of *Flieger Kompagnie* (FlKp) 21 (21st Flight Company) – was briefly painted on this aircraft in the summer of 1940. (A company was equivalent to a squadron.) Swiss Air Force Bf 109Es had a single 960-round ammunition box mounted on the starboard side nose, which these mechanics have removed for reloading. Luftwaffe *Emils* had two 1000-round ammunition boxes. (Swiss Air Force Museum via Roland Küng)



This same Bf 109E-3 (J-313; *Werk Nummer* 2161) has received its armament. The two large blisters atop the engine cowling– typical for Luftwaffe *Emils* – were deleted and two small, rectangular blisters were fitted in front of the cockpit. J-313 was unusual in having an additional circular blister placed just below the two machine gun gas exhaust slots. This blister was rarely seen on Swiss *Emils*. (Swiss Air Force Museum via Roland Küng)

The Bf 109E-3 (J-313; *Werk Nummer* 2161) was repainted with the markings used between September of 1945 and December of 1949. Red and White neutrality stripes were retained on the wing undersurfaces, but deleted from the upper surfaces and rear fuselage. The national marking was also overpainted on the fuselage. Two White warning stripes were painted on each RLM 70 Black Green propeller blade. An armor plate was also mounted in the rear canopy framing, a modification that had been executed after the end of World War Two. (Swiss Air Force Museum via Roland Küng)

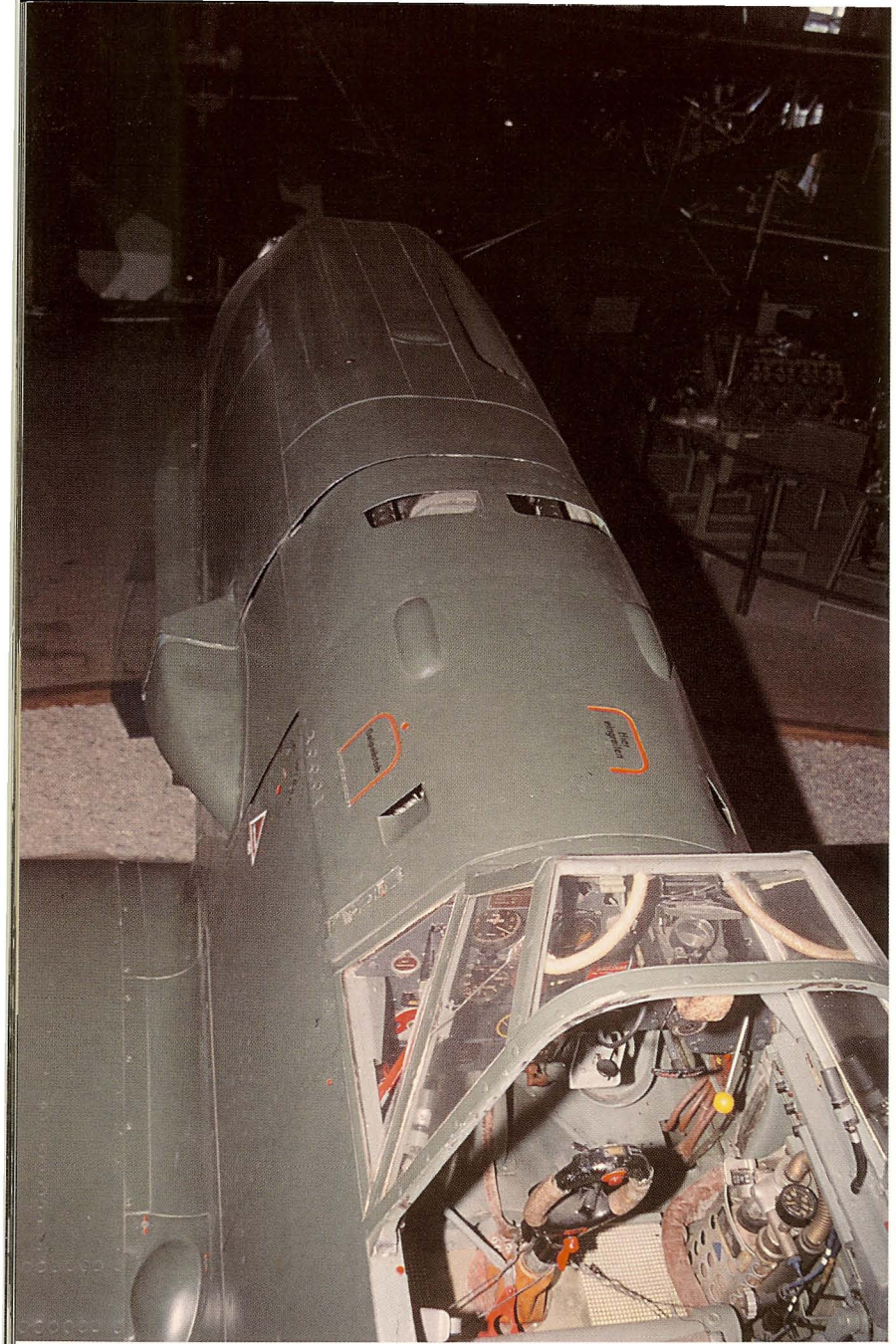




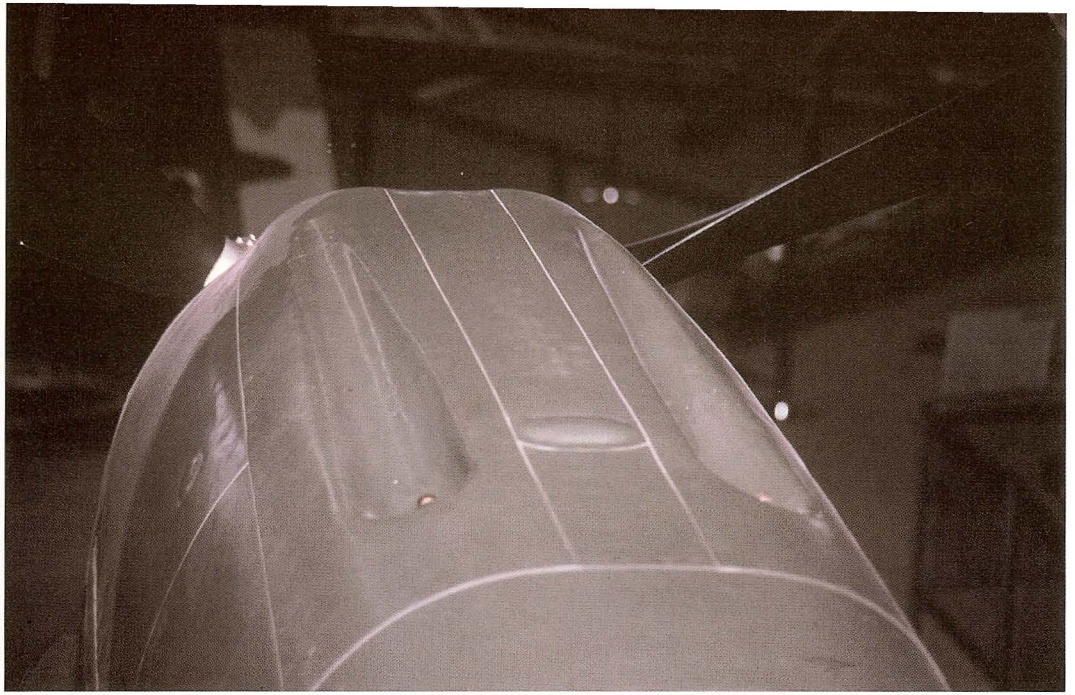
(Above) The first batch of 30 *Fliegertruppe* Bf 109E-3s were delivered with RLM 70 *Schwarzgrün* (Black Green) and RLM 71 *Dunkelgrün* (Dark Green; FS34079) upper surfaces. These colors were applied in a soft edged camouflage pattern, instead of the hard-edged splinter scheme used on Luftwaffe aircraft. This unarmed Bf 109E-3 (J-333; *Werk Nummer* 2191) is parked shortly after arrival at Dübendorf Air Base near Zurich in the summer of 1939. (Swiss Air Force Museum via Roland Küng)

(Above Right) The second series of 50 Swiss *Emils* – including J-353 (*Werk Nummer* 2420) – were finished with RLM 70 Black Green upper surfaces over RLM 65 Light Blue undersurfaces. The entire rudder was painted Red, with a White cross in the upper half, while the large White code is painted on the fuselage. *Fliegertruppe* Bf 109E-3s wore these markings between January and April of 1940, when national markings were added to the fuselage. (Swiss Air Force Museum via Roland Küng)

(Right) A *Fliegertruppe* Bf 109E-3 (J-318; *Werk Nummer* 2166) taxis across a snow-covered airfield in late 1940. In January of that year, Swiss Bf 109E-3s had their entire rudders painted Red with the White Cross. This surface originally had only the upper half in Red and the lower half in camouflage. The Swiss replaced the RLM 71/71 upper surface camouflage of their *Emils* with a solid Dark Green finish similar to RLM 70 Black Green in April of 1940. Additionally, national markings were painted on the fuselage sides and the White aircraft codes reduced in size. (Swiss Federal Archives)

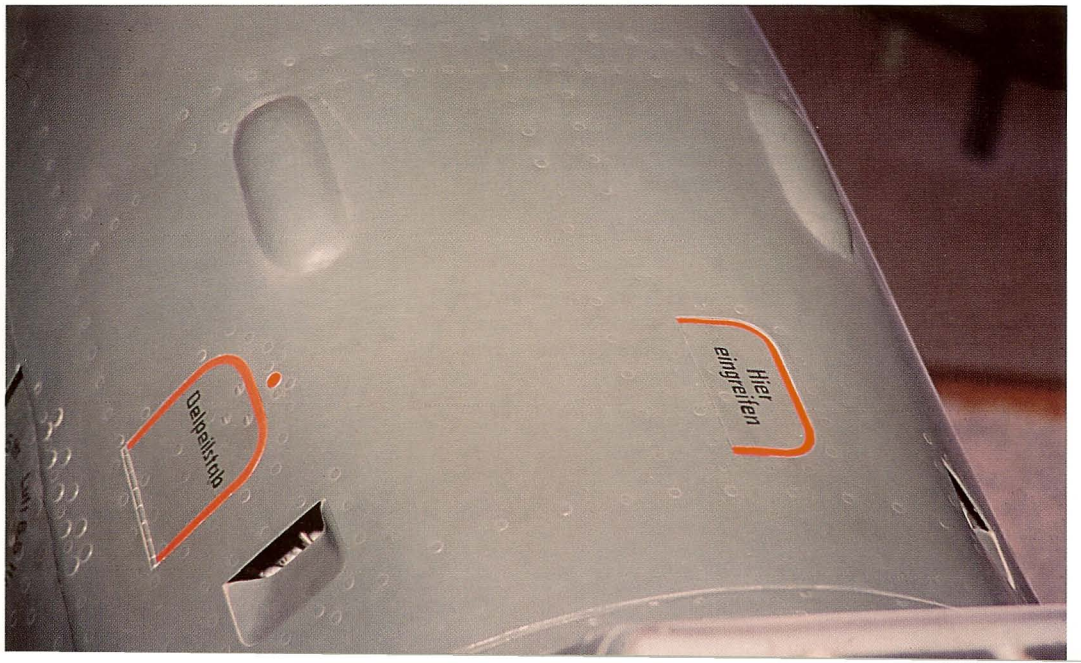


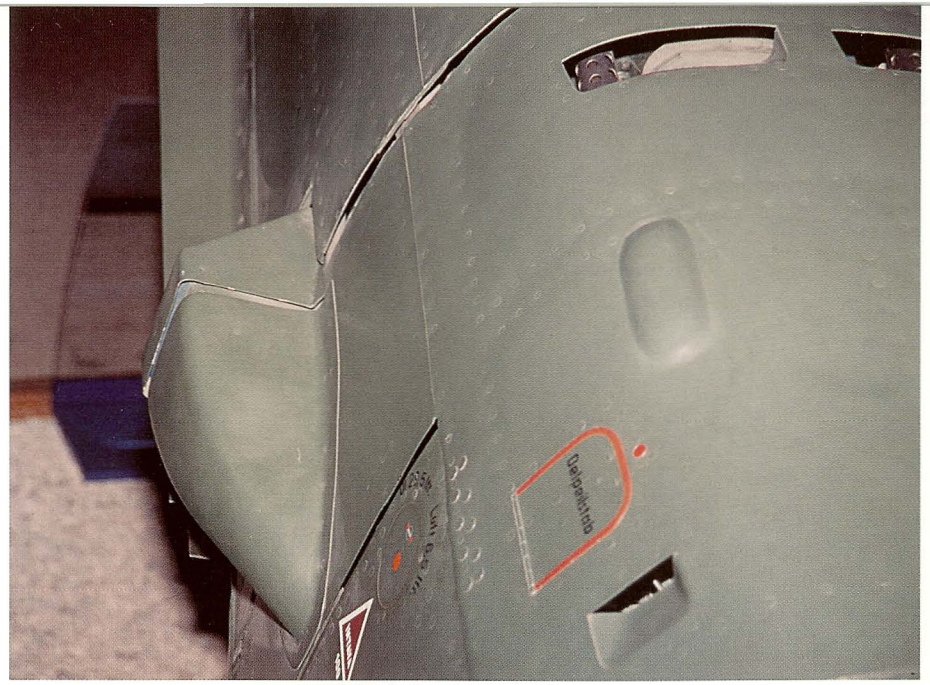
Two small rectangular blisters appear in front of the cockpit of Swiss Bf 109E-3s. These blisters are unique to these *Emils* and were not found on German Bf 109Es. Two handhold rails are mounted in the upper windshield frame. (Walter Hodel)



Two machine gun troughs are set into the Bf 109E-3's upper engine cowling. These troughs were similar to those on Luftwaffe *Emils*. The small blister between the gun troughs was rarely seen on Swiss Bf 109E-3s. The distance between these troughs was 4 CM wider than on German Bf 109Es, due to the side-by-side arrangement of the Swiss *Emil*'s MG 29 machine guns. (Walter Hodel)

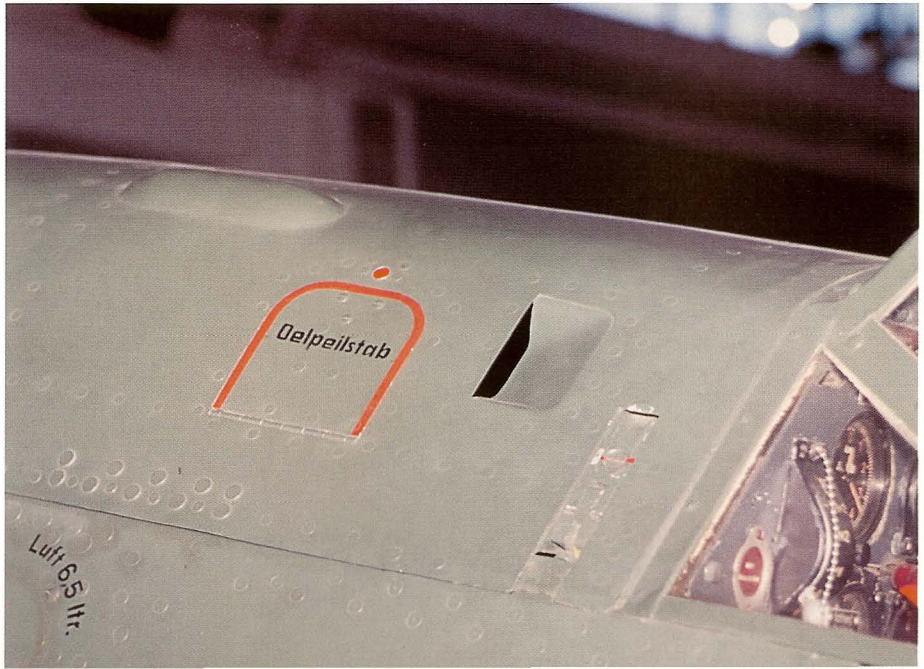
Two small rectangular blisters ahead of the windshield were typical on Swiss Bf 109E-3s. A handhold is located atop the nose and offset to starboard. A small access door is mounted on the port side. Both features were introduced on German Bf 109Es. The doors are outlined in Red with Black stenciling. (Walter Hodel)





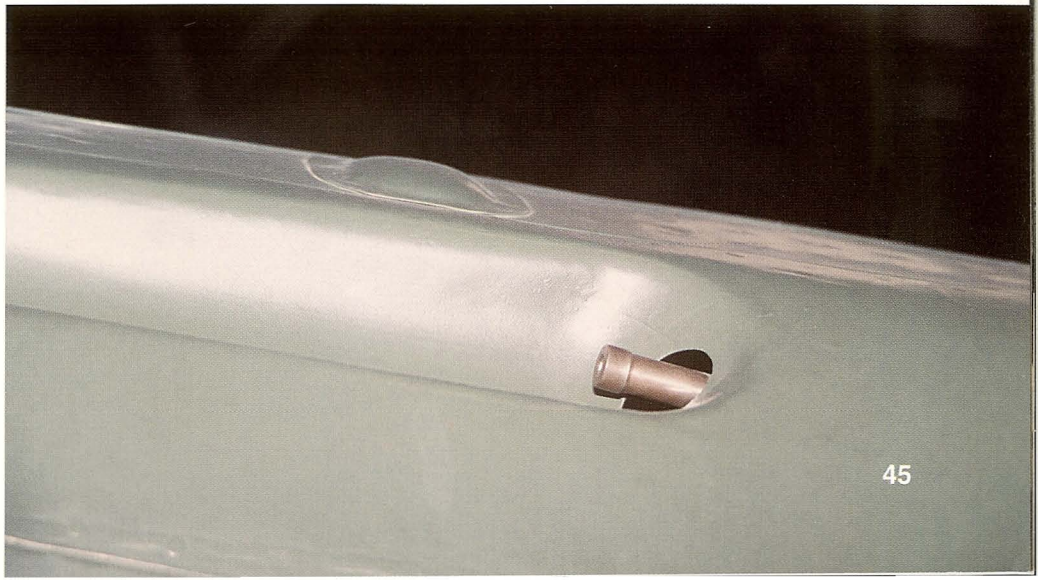
Swiss Bf 109E-3s employed the same supercharger intake as other *Emils*. This intake was only mounted on the port forward fuselage. Two slots atop the cowling vented hot gases from inside the machine gun compartment. (Walter Hodel)

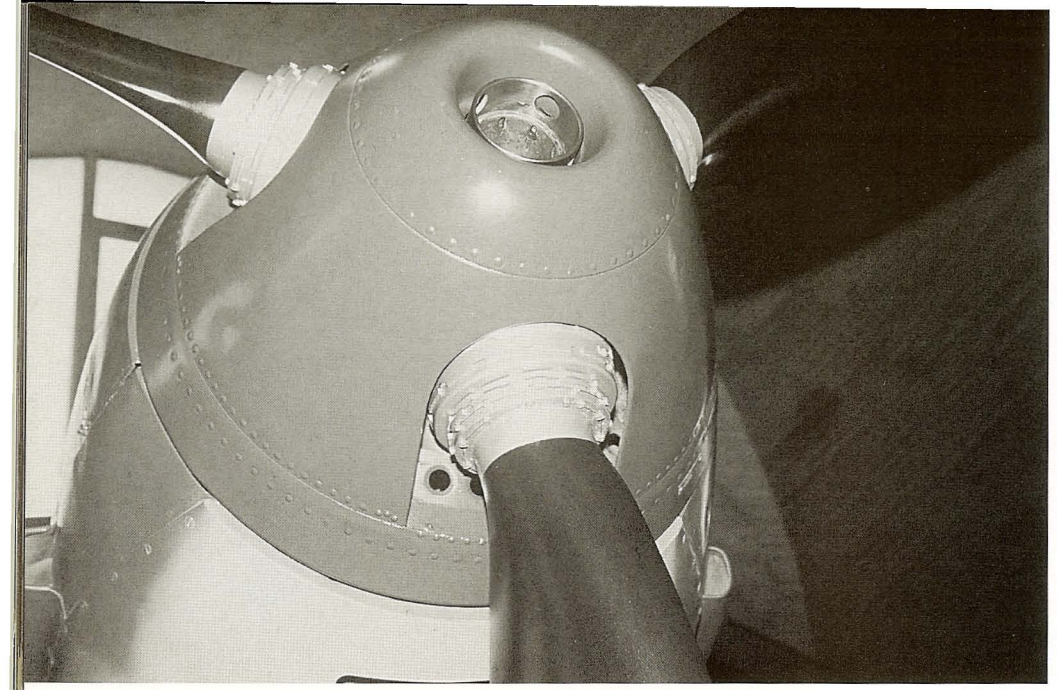
The Red-outlined oil level access panel is mounted on the port upper engine cowling, immediately above the oil filler point. An outlet is placed behind this access panel. Both features were also found on standard German *Emils*. An upper engine cowling release is located in front of the windshield. (Walter Hodel)



A circular plate aft of the supercharger air intake covered the oil filler point. This plate had a flush-mounted snap-fit attachment. *Öl 29,5 ltr. Luft 6,5 ltr.* (Oil 29.5 L Air 6.5 L) is painted in Black above the plate. The Swiss used a Red and White triangle for oil filler point identification. (Walter Hodel)

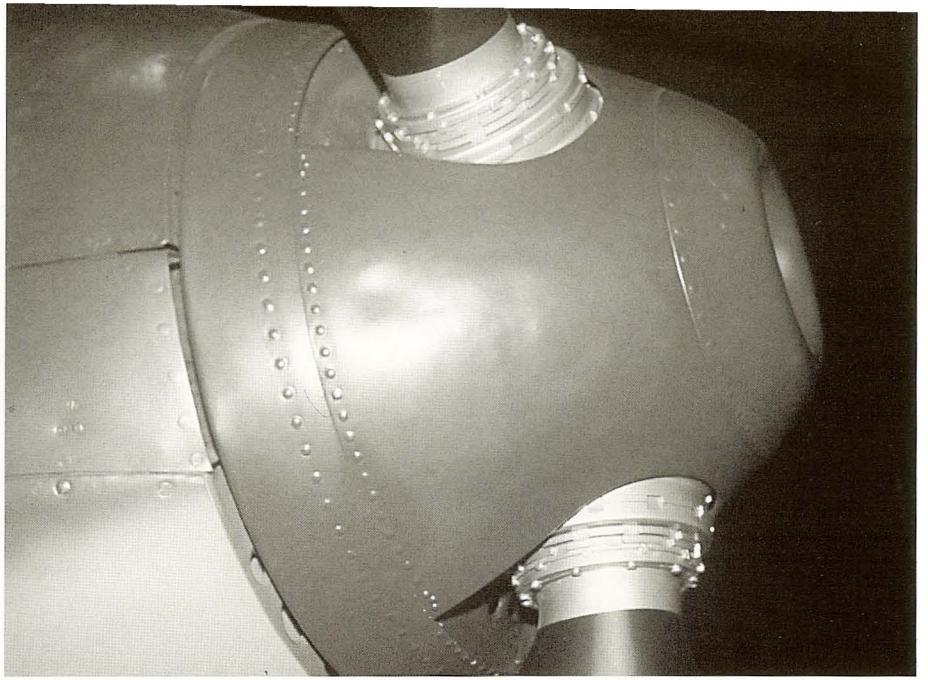
Both 7.45MM *Eidgenössische Waffenfabrik* (EW; Federal Arms Factory at Berne) MG 29 machine gun muzzles were visible on both sides of the engine cowling. The MG 29s were placed side-by-side, while the Germans staggered their 7.92MM Rheinmetall-Borsig MG 17s. The MG 29 *Flieger-Maschinengewehr* (Aircraft Machine Gun) had a muzzle velocity of 780 M (2559 feet) per second and a firing rate of 1300 rounds per minute. These EW weapons fired the same GP 11 (*Gewehr Patrone*/Rifle Cartridge) rounds the Swiss Army's standard *Karabiner 31* rifle used during World War Two. (Walter Hodel)





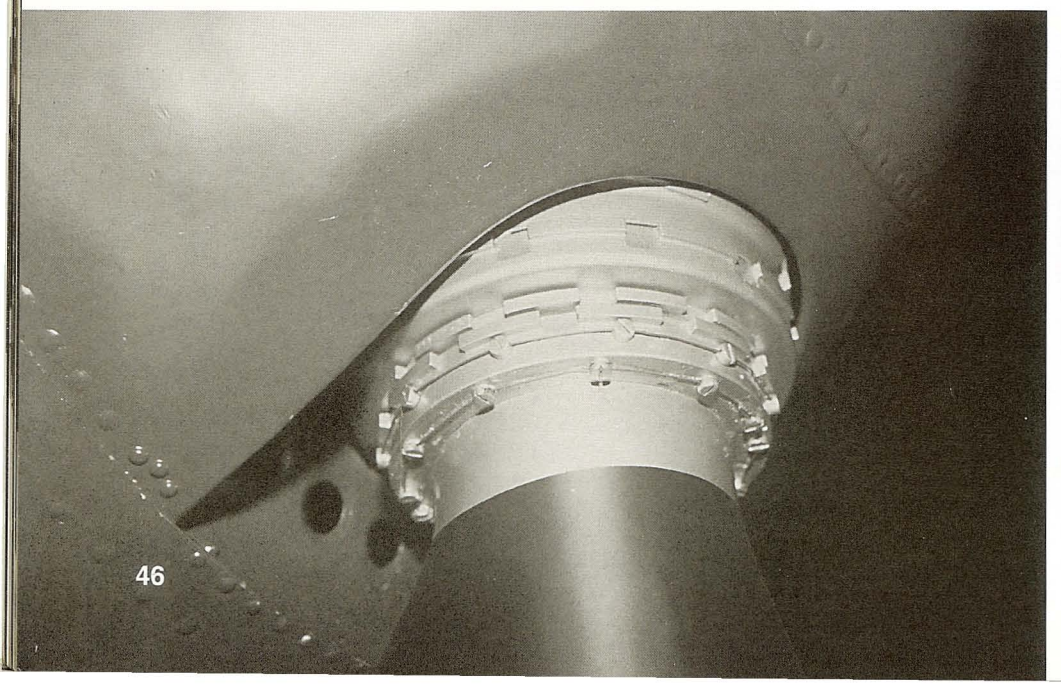
Both Swiss and German Bf 109E-3s employed the same propeller spinner. The aperture in the center allowed a 20MM MG FF cannon to be fired through the hollow propeller shaft. This weapon was not fitted to Bf 109E-3s, but was installed on the later Bf 109F. All *Emils* used an all-metal three-bladed VDM constant speed propeller, which had a diameter of 3.1 M (10 feet 2 inches).

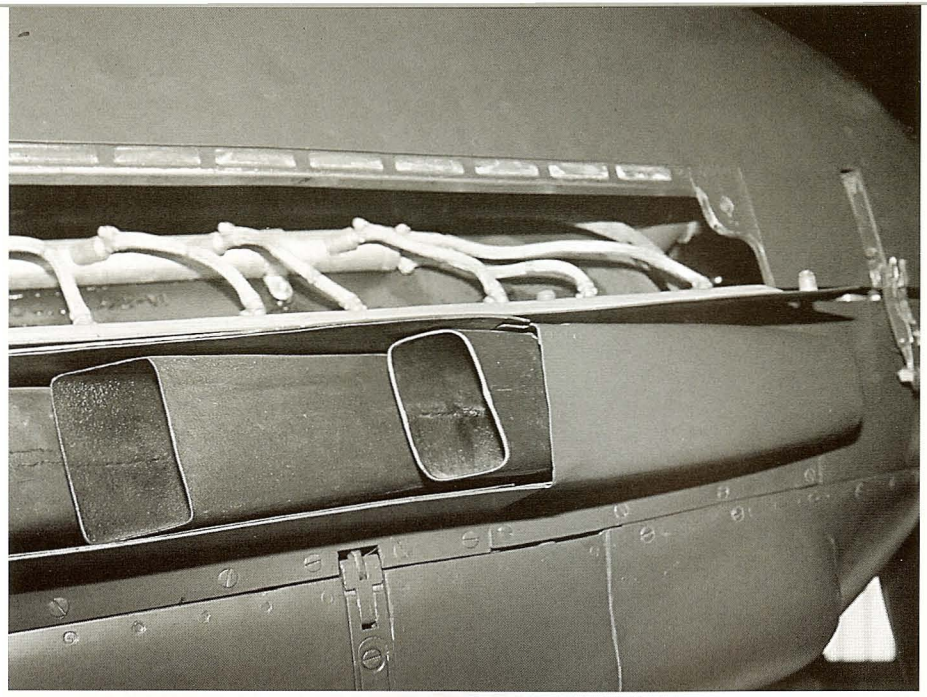
The pitch change mechanism is located at the base of each VDM propeller's blade. Adjusting the blades' pitch allowed for more efficient flight under all flight conditions. Circular apertures were cut into the spinner backplate as a weight-saving measure.



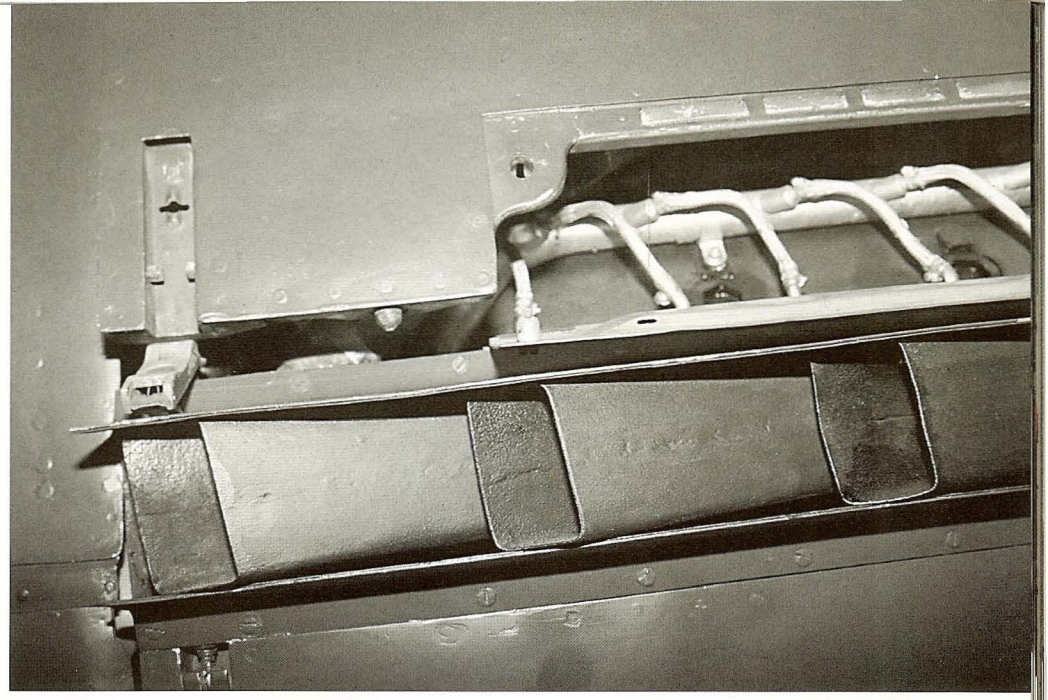
The propeller governor unit consisted of a small centrifugal governor driven at half engine speed. Loading of the governor spring was varied by a cam bearing on a roller fitted to the pilot's throttle lever. The governor movement operated a two-way switch in the electric motor that adjusted the propeller's pitch.

A Light Blue outlined coolant filler access door is mounted on the port side of this Swiss Bf 109E-3. Its filler point is located immediate aft of the propeller spinner. The German stenciling on this hatch reads: *Vorsicht Dampf bei heissem Motor* (Beware of vapor on the hot engine).





The starboard spark plug and plug wiring access panel is opened on the Swiss Air Force Museum's Bf 109E-3. Snap-fit enclosures were used on all cowling parts and their panels. The *Emil* did not use screws that contemporary fighter aircraft employed, which eased the ground crew's work maintaining the Bf 109E in the field. The inverted V-12 engine allowed more room for the nose armament.



A snap-fit enclosure for the upper engine cowling is located above the rearmost starboard exhaust stacks. Wiring below the stacks led to the two Bosch DW 240 ET 8 spark plugs attached to each cylinder, which made for a total of 24 spark plugs on each Daimler-Benz DB 601A 12-cylinder engine.

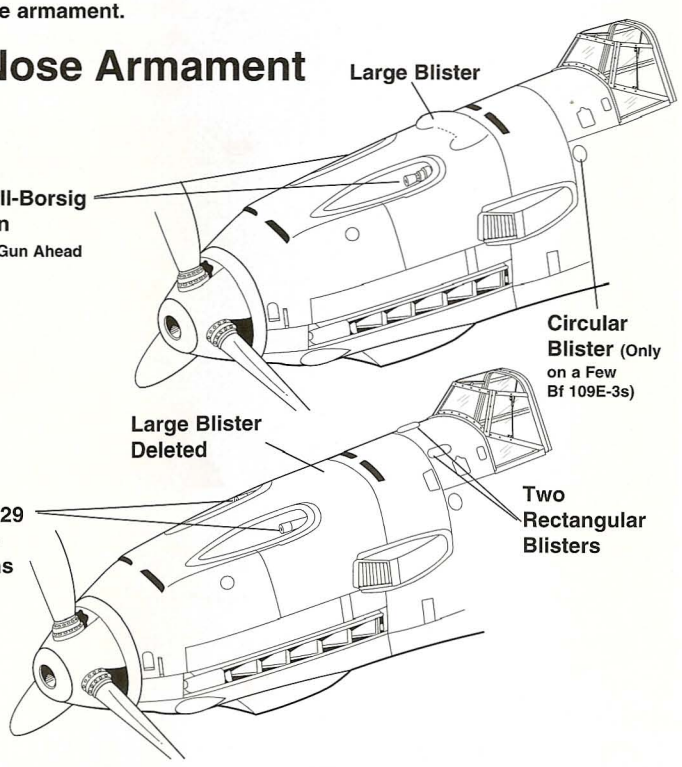
Bf 109E-3 Nose Armament

German

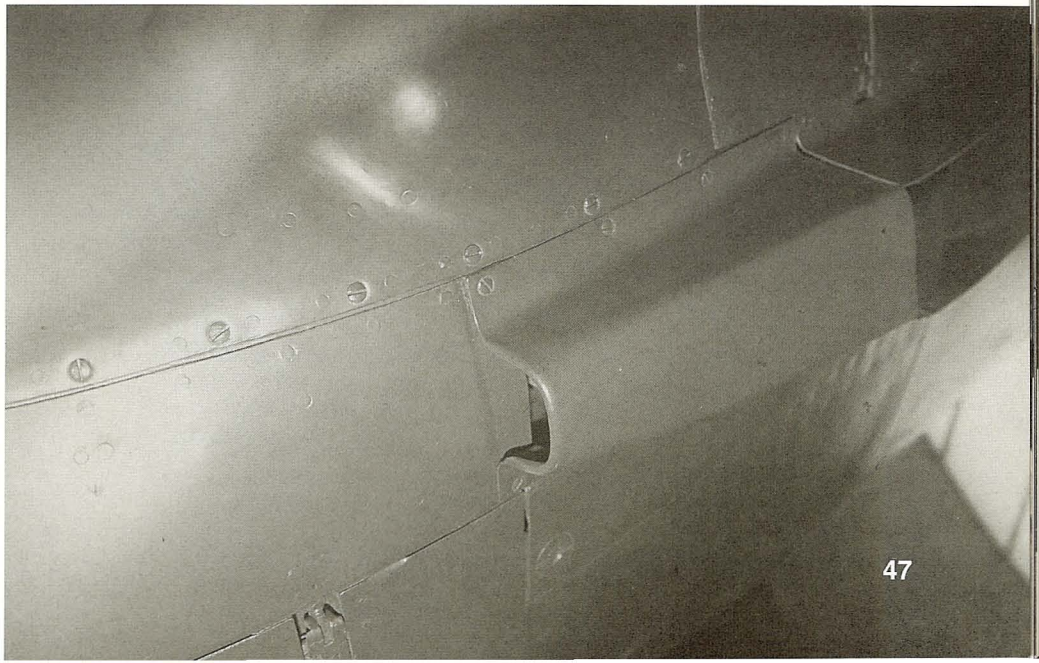
Two 7.92MM Rheinmetall-Borsig MG 17 Machine Guns in Staggered Mount. (Port Gun Ahead of Starboard Gun)

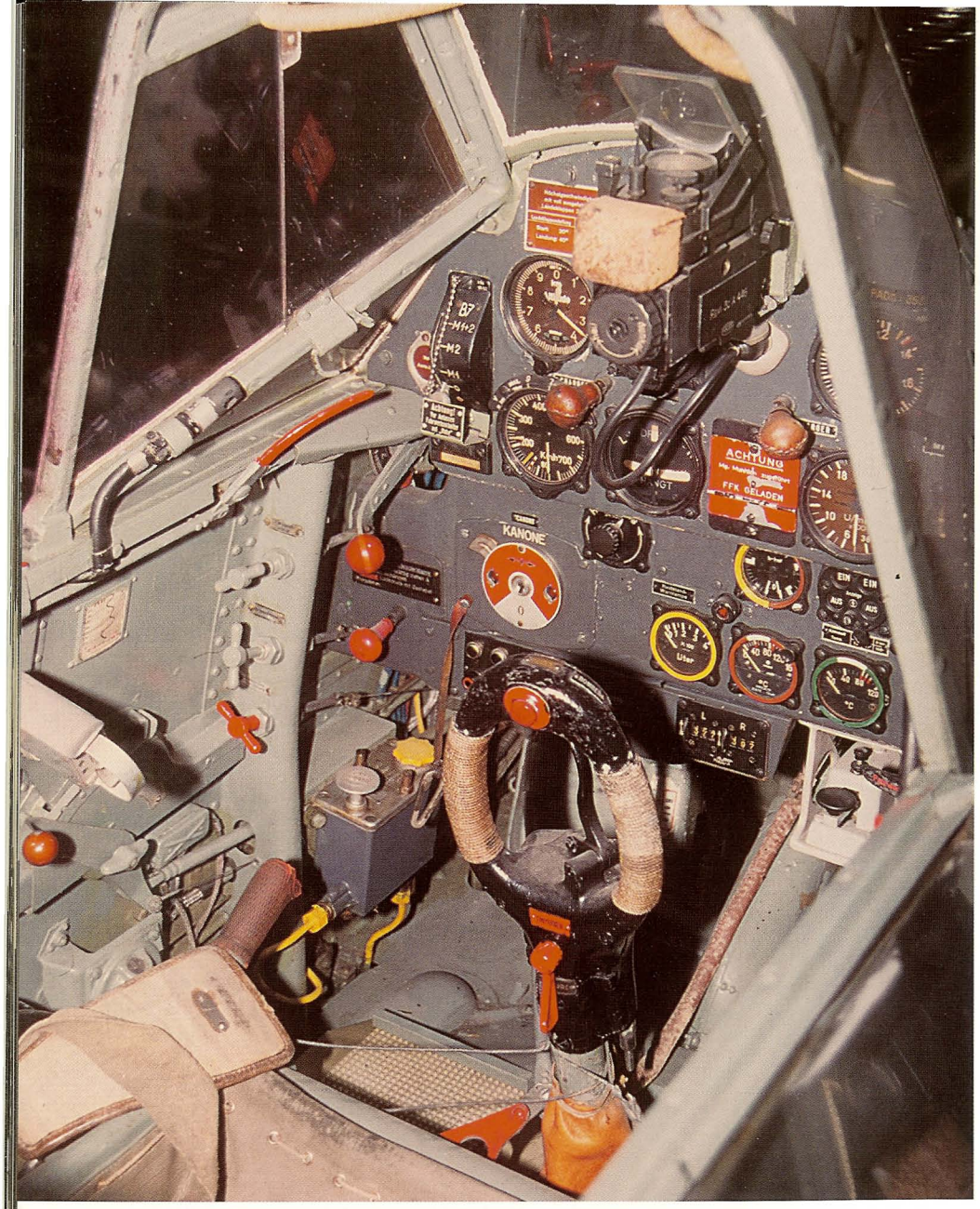
Swiss

Two 7.45MM *Eidgenössische Waffenfabrik* (EW) MG 29 Machine Guns in Side-by-Side Mount. Troughs are 4 CM (1.6 inches) wider than on the German Bf 109E.

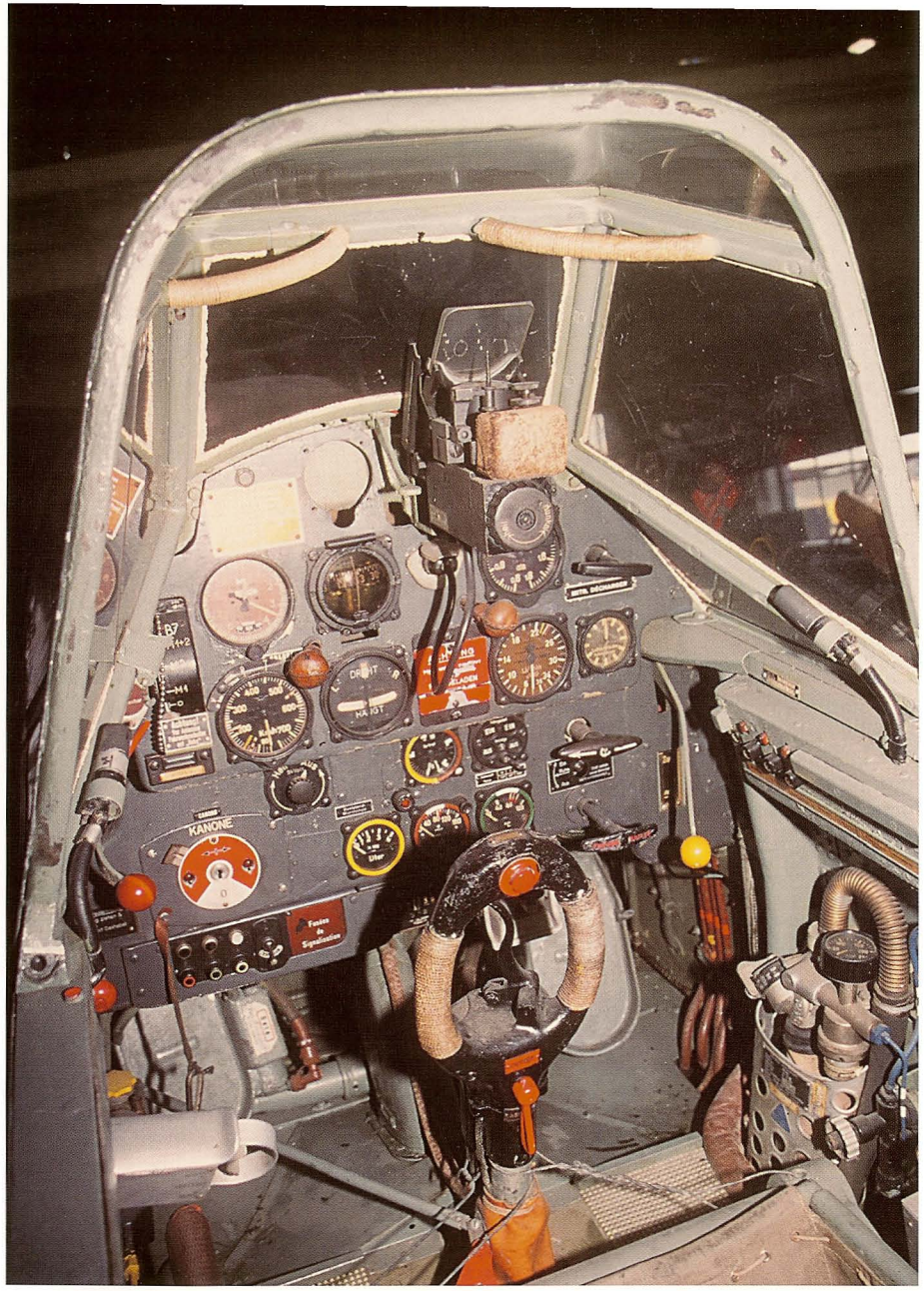


A tunnel-shaped covering is mounted in front of the Bf 109E's exhaust stacks. This tunnel fed cooling air over the six stacks per side. Part of the skinning was bolted to the frame and could not be easily removed from the aircraft.

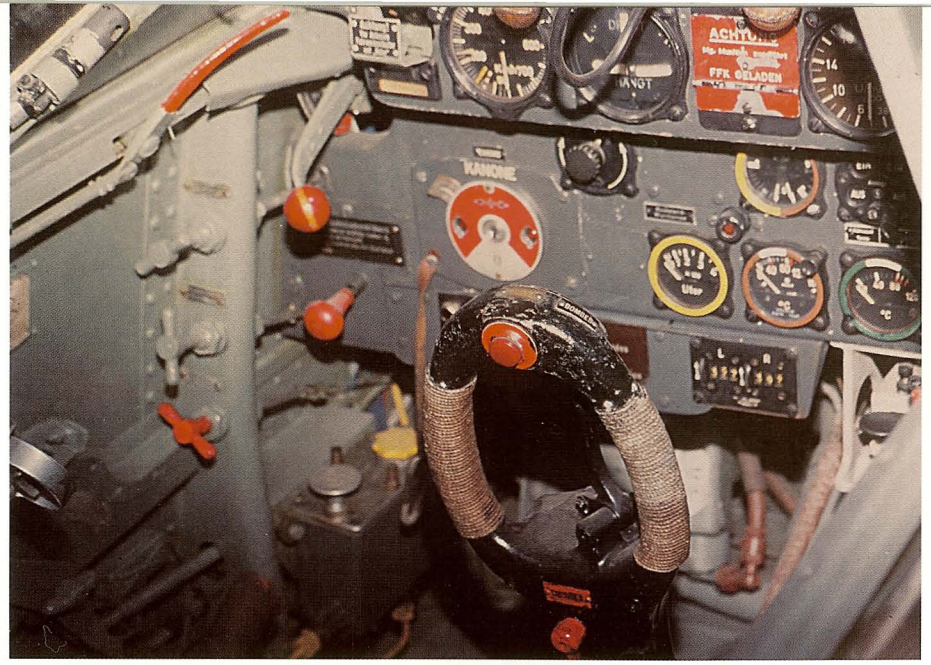




The restored Swiss Bf 109E-3 has the cockpit configuration at the time it was withdrawn from service in December of 1949. This cockpit does not match the markings applied on the aircraft, which represents a Bf 109E-3 in early 1940. The instrument panel was painted RLM 66 *Schwarzgrau* (Black Gray; FS36081), while the rest of the cockpit appears to be RLM 02 RLM-*Grau* (RLM Gray; FS36165). Bf 109Es normally had RLM 02 Gray cockpits until late 1941, when they were changed to RLM 66. (Walter Hodel)

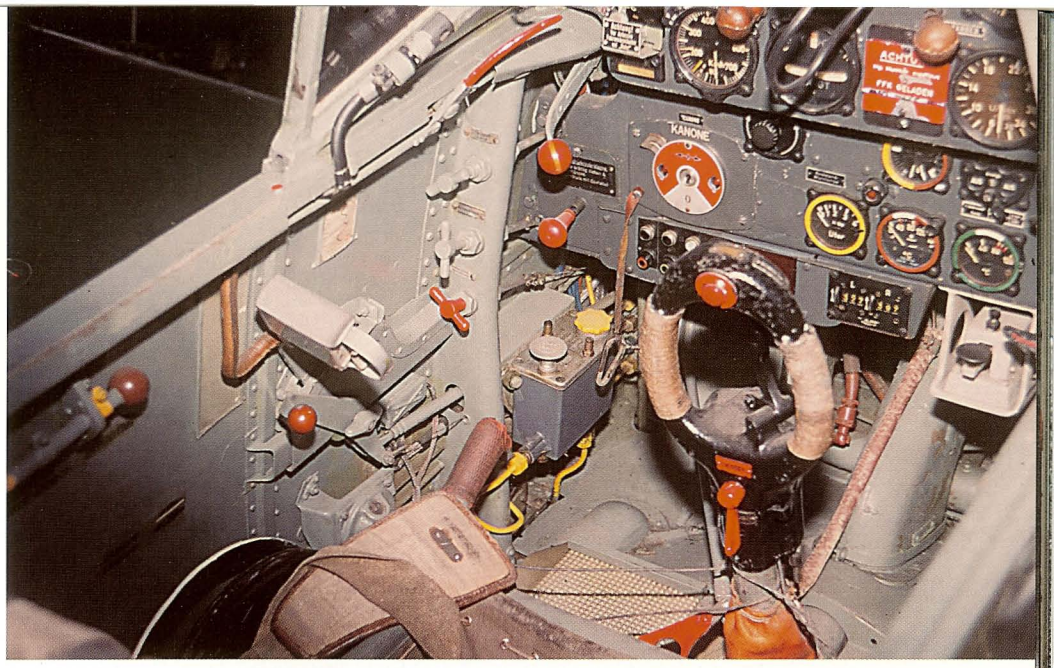


Swiss Bf 109E-3s used a circular spade grip atop the KG 11 control stick. This grip – similar to those employed by contemporary British aircraft – was different from the Luftwaffe's boom-type stick. The Black T-shaped handle on the upper starboard instrument panel charged the fuselage-mounted MG 29 machine guns. German *Emils* lacked this handle, since their MG 17 machine guns employed electro-pneumatic charging. (Walter Hodel)



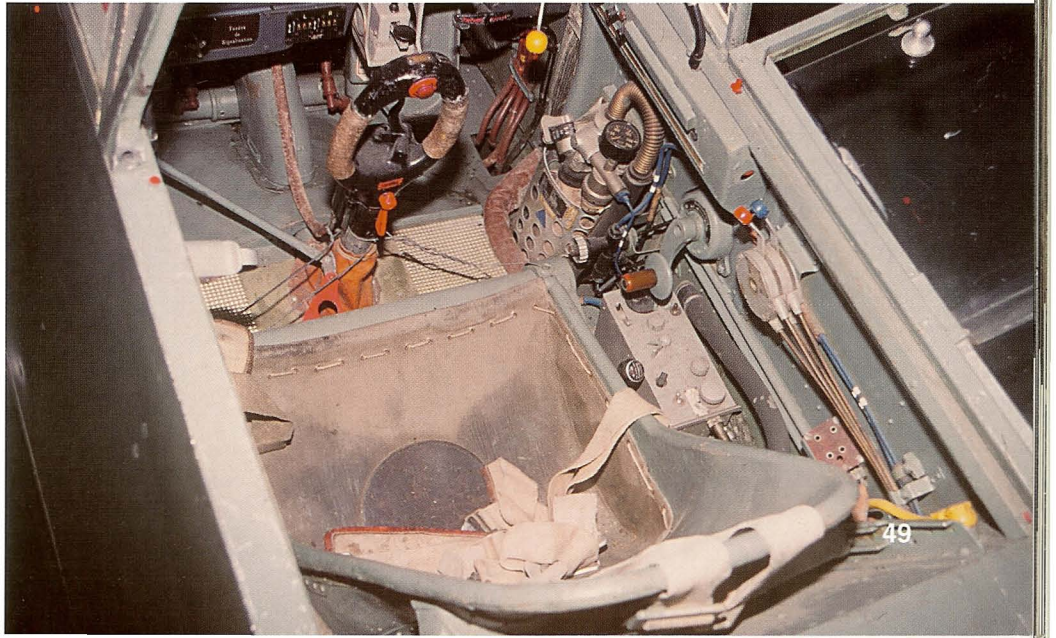
The Swiss Bf 109E-3 instrument panel differed in several details from those on German *Emils*. A notable difference was the Red and White 20MM cannon arming device above the control stick. The pilot inserted a key into this mechanism, which enabled the wing-mounted cannon to fire. German Bf 109Es lacked this device. The *Fliegertruppe* introduced this cannon arming mechanism late in the aircraft's service to replace an older device. (Walter Hodel)

A Yellow-handled fuel filter hand pump is mounted on the instrument panel's starboard side. The Swiss-made Revue Thommen clock is missing from the upper instrument panel. Swiss aviation clocks were also used in both German and British aircraft during World War Two. (Walter Hodel)



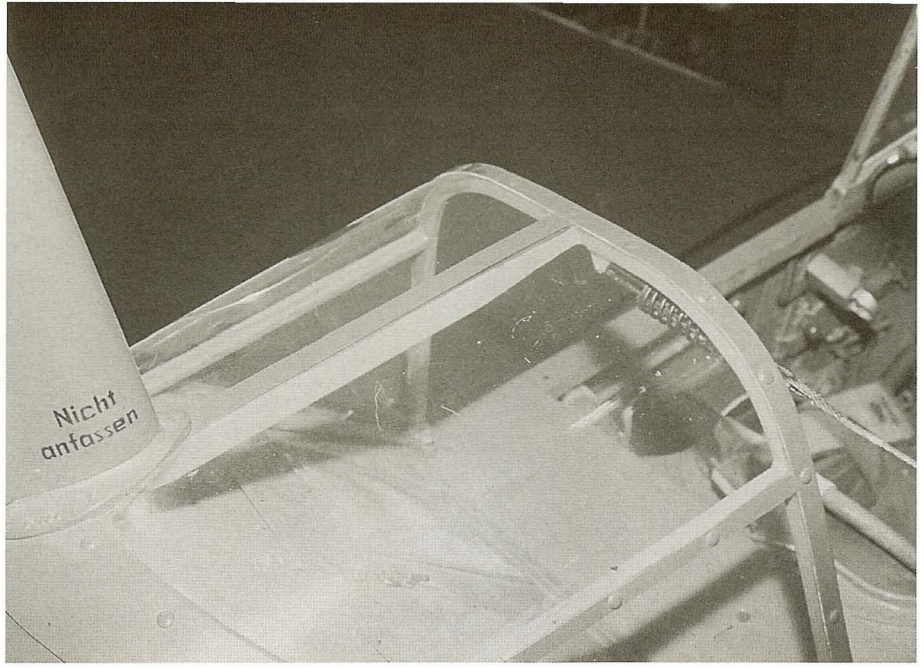
The throttle quadrant is mounted on the port cockpit wall, aft of the instrument panel. A Morse Code telegraph device is mounted below the starboard side of the lower instrument panel. German aircraft lacked this device, which Swiss pilots were trained to use instead of voice communication. (Walter Hodel)

The Swiss Bf 109E-3 pilot's seat was the same as for German *Emils*. This seat bucket accommodated a parachute, which also served as a seat cushion. The oxygen regulator was mounted inside the perforated container along the starboard cockpit wall. Swiss Bf 109E-3s lacked the rear armor protection fitted to German *Emils* during the war. (Walter Hodel)



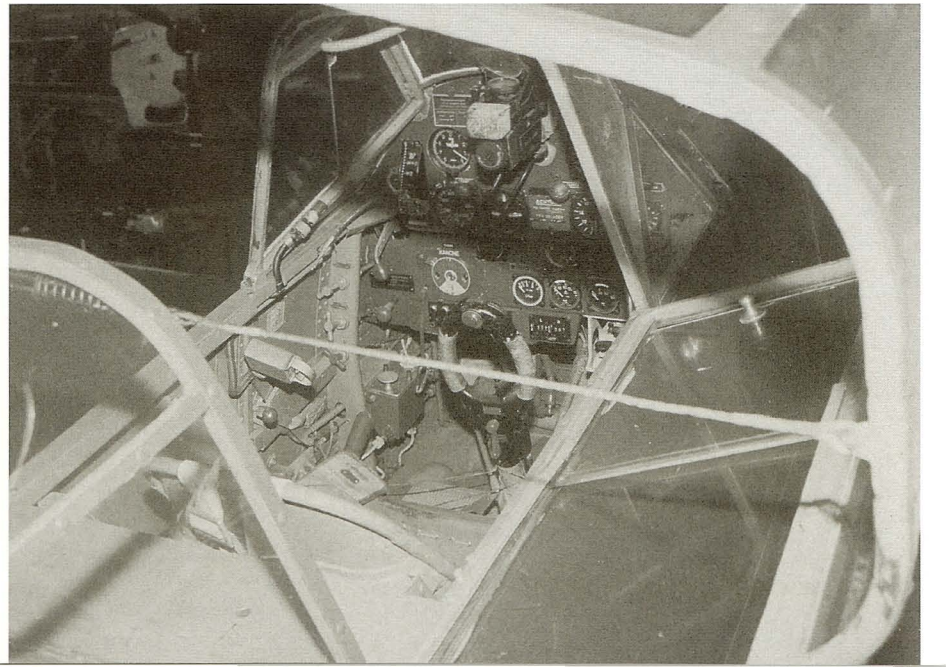
The canvas shoulder belt is mounted behind the pilot's seat on this preserved Swiss Bf 109E-3. This harness combined with a lap belt to secure the pilot to his seat. Swiss *Emils* employed a different throttle than Luftwaffe aircraft.

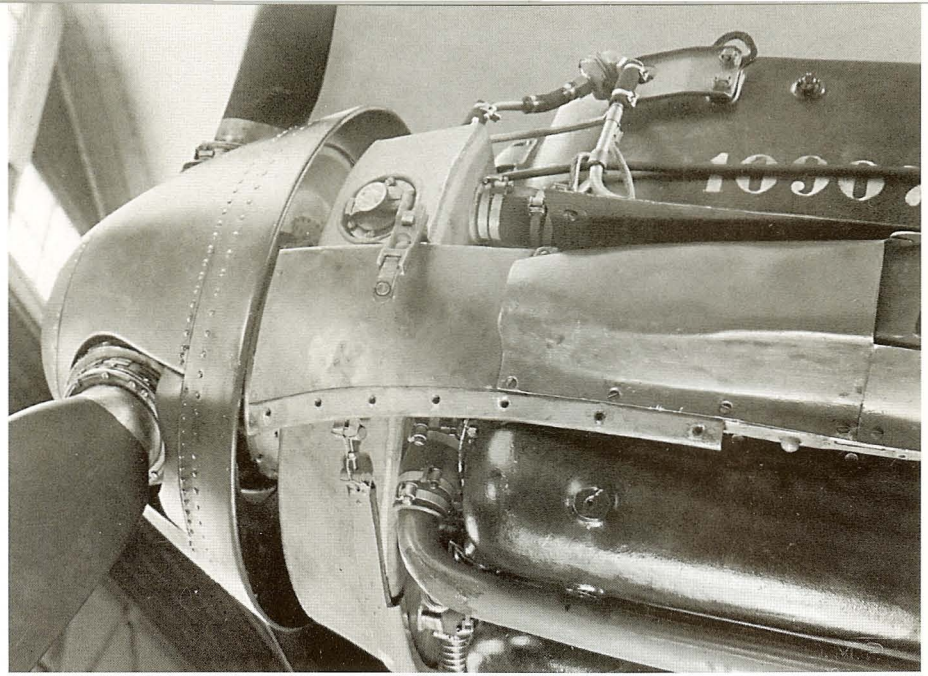
Swiss *Emils* differed from Luftwaffe aircraft in having a maintenance card mounted on the port rear cockpit. This was used to place attachments regarding the aircraft's status. The spring for the canopy cable is mounted on the aft canopy section. The cylindrical canopy handle is mounted on the lower port center section frame. All Bf 109Es had triangular lower windshield panels. (Walter Hodel)



The antenna mast was bolted to the rear canopy center frame on the Swiss Air Force Museum's Bf 109E-3. This mast was located on the canopy edge and supported the front end of the antenna cable strung to the tail. *Nicht anfassen* (Do not touch) was painted in Black at the antenna's base.

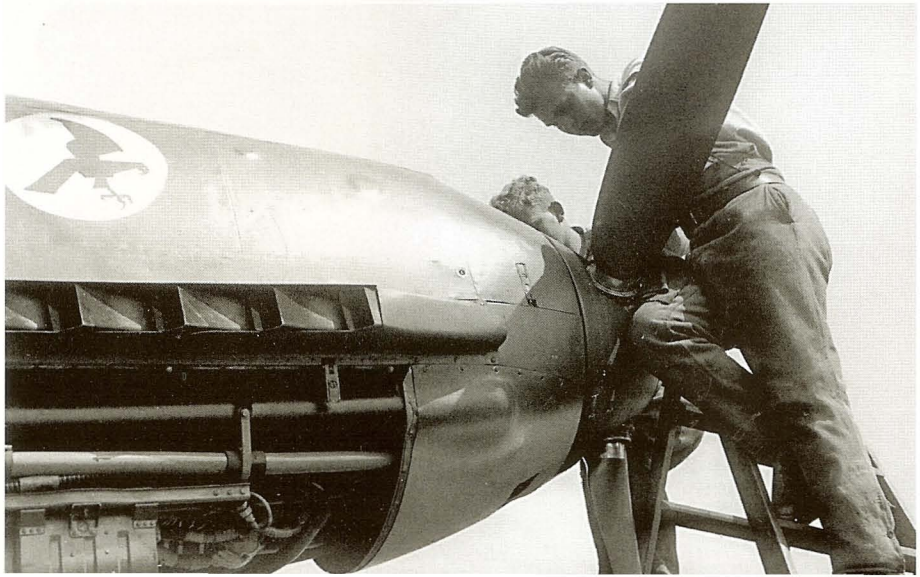
The canopy center section was opened to starboard. A cable connected the rear canopy frame and the center section's upper rear frame. This prevented the section from rolling onto the starboard fuselage side. A spring was added to the rear canopy cable attachment point.

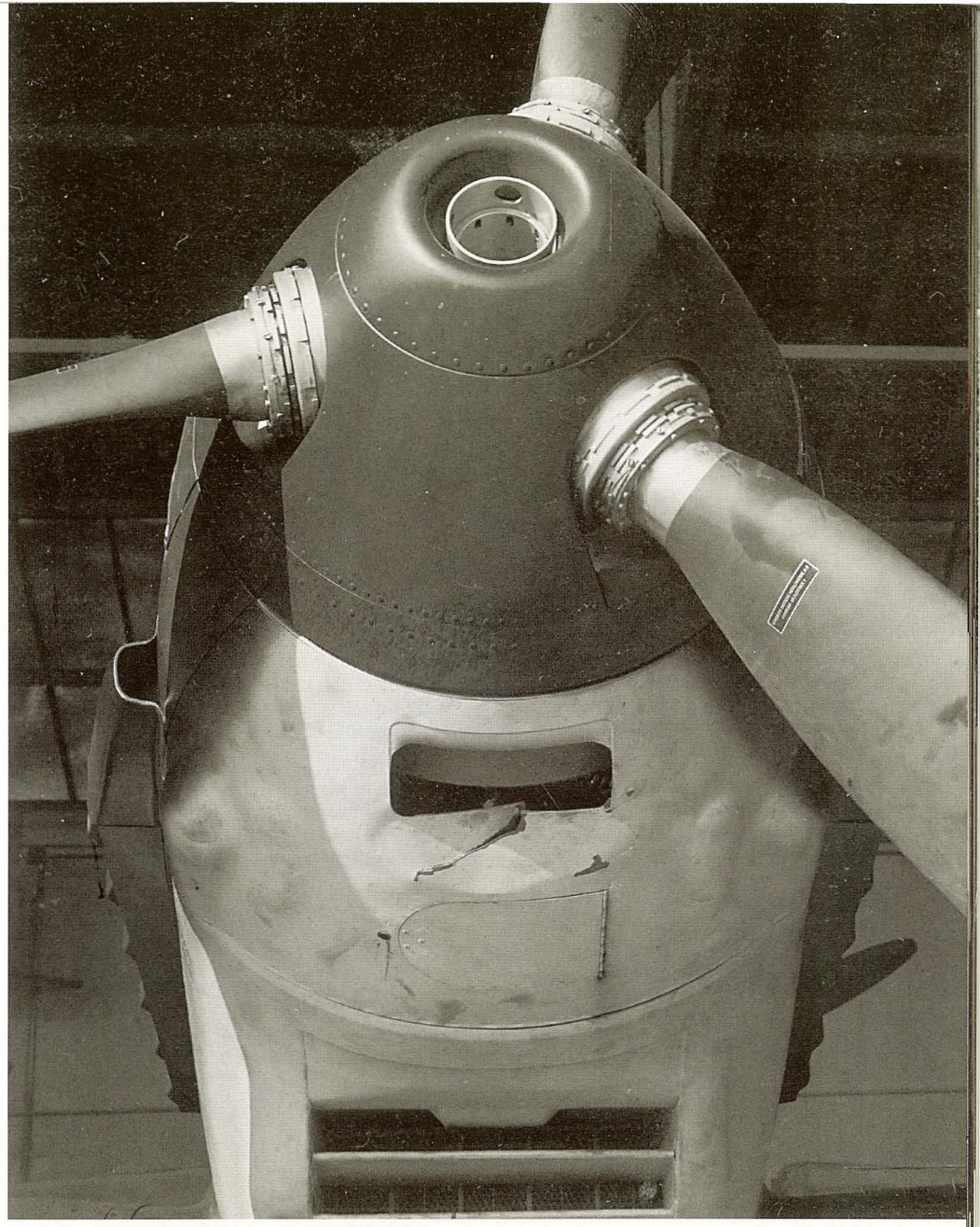




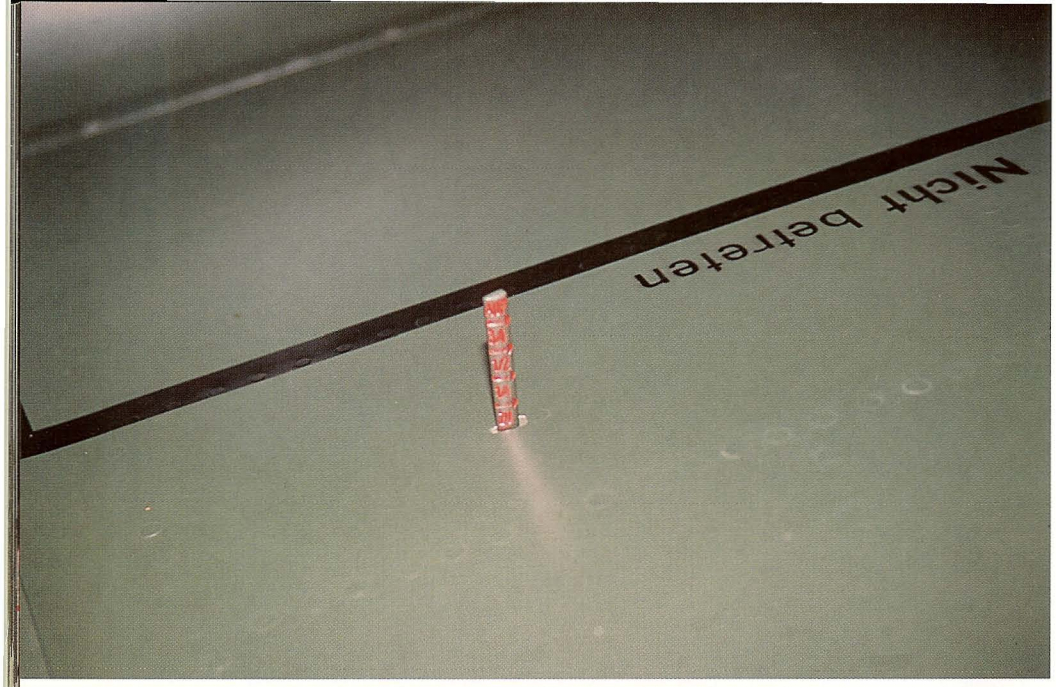
Both the upper and lower cowlings are removed, which exposes the oil tank in front of the engine. The Bf 109E's Daimler-Benz DB 601A engine was supplied with 29.5 L (7.8 gallons) of oil. Rubber tubing carried coolant from the oil tank to the oil cooler mounted below the engine. The serial number 10907 – painted in either White or Yellow – identified a DB 601A installed on Swiss Bf 109E-3 J-350 (*Werk Nummer* 2407). This engine later seized and was replaced on the fighter. (Swiss Air Force Museum via Roland Küng)

Two Swiss mechanics overhaul a FlKp 15 Bf 109E-3 during the summer of 1940. The *Kompanie* insignia is painted on the engine cowling. The lower cowling was removed for access to engine components. *Fliegertruppe* Bf 109E-3s saw action against intruding Luftwaffe Heinkel He 111 bombers and Messerschmitt Bf 110 heavy fighters in May of 1940. Squadron insignias were not painted on *Fliegertruppe* aircraft during these battles with the Luftwaffe. (Swiss Federal Archive)



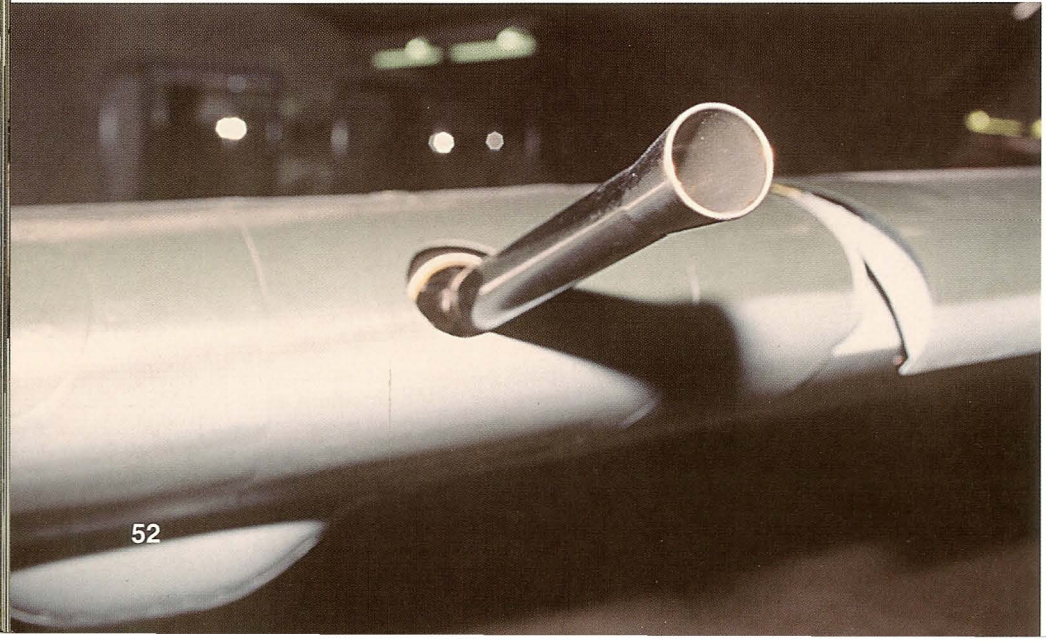


This Swiss *Fliegertruppe* Bf 109E-3 sustained minor damage near the rectangular oil discharge vent. Damage of this extent was easily repaired at the squadron level. A snap-fit access panel was located aft of the oil discharge vent, while the oil cooler intake was positioned further aft on the undersurface. The propeller spinner was painted the same RLM 70 Black Green as the aircraft's upper surfaces. (Swiss Air Force Museum via Roland Küng)



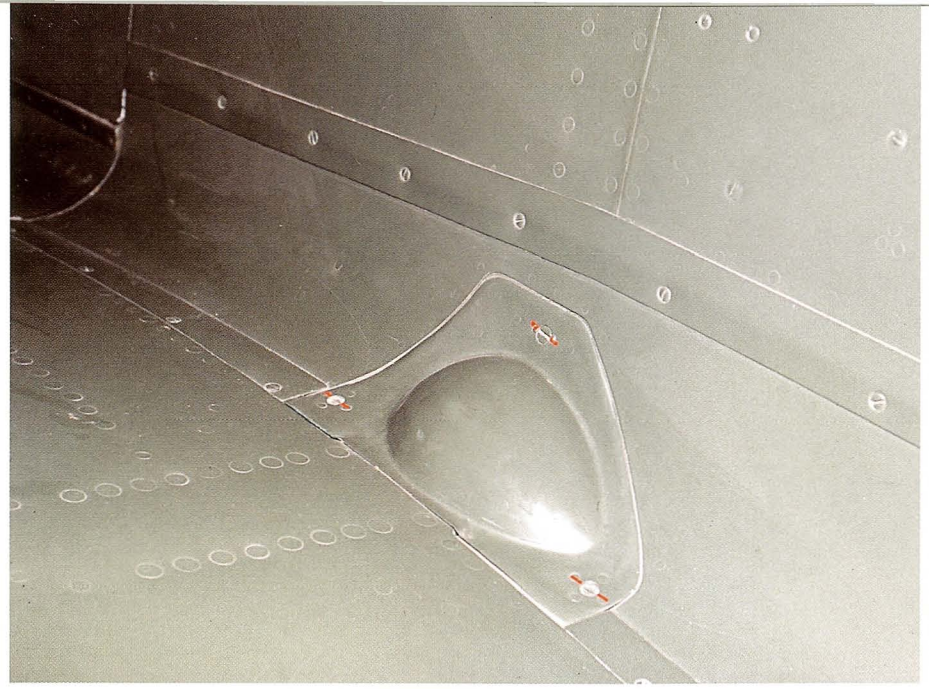
A flap position indicator protrudes from the upper wing surface near the walkway. One indicator was installed in each Bf 109E's wing. The pilot looked out of his canopy towards this indicator to know how far his flaps were extended. Inscriptions were in Red on the outboard section and White on the inboard section that the pilot saw from his cockpit.

The 20MM FF-K Oe 37 (*Flugzeugflügel-Kanone Oerlikon 1937*/Wing-Mounted Cannon Oerlikon 1937) has a funnel-shaped blast tube compared to that fitted to the German *Emil*'s MG FF cannon. This Swiss weapon was manually charged on the ground, while the Germans employed electro-pneumatic charging on their Bf 109Es. The bulge on the wing undersurface accommodated the weapon's 60-round ammunition drum.

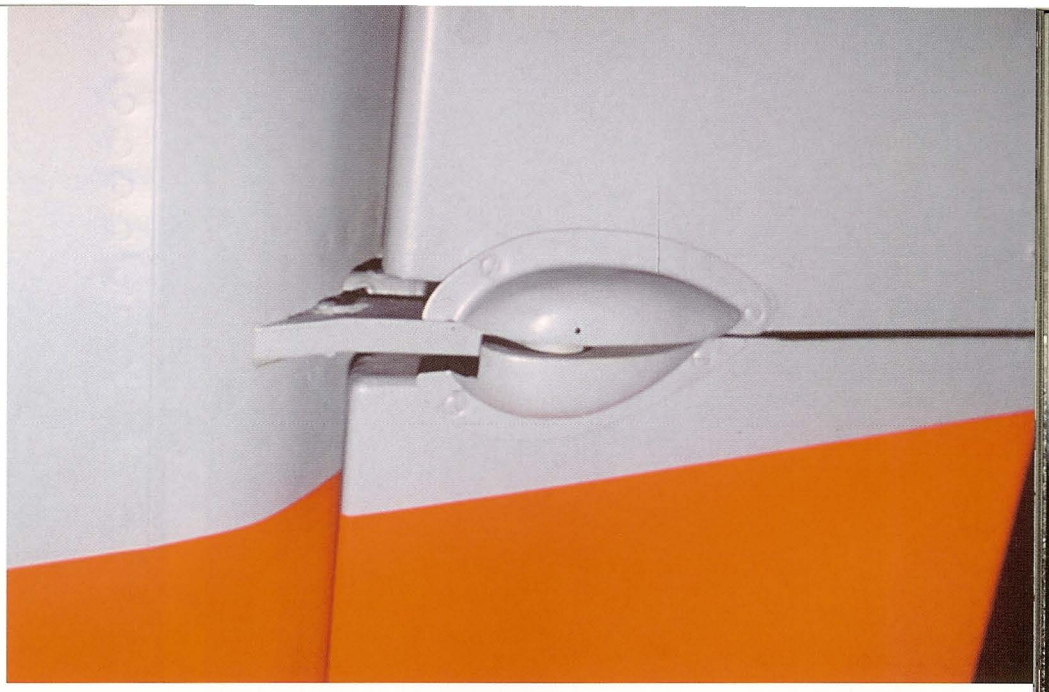


The Green starboard position light is mounted on the forward half of the wingtip. A Red light is located on the port wingtip. The leading edge slat was fully extended on this display aircraft. This slat automatically extended from the wing when the Bf 109E was at a high angle of attack.

Werkzeugmaschinenfabrik Oerlikon of Zürich built the 20MM FF-K Oe 37 cannon. This weapon had the same performance as the German MG FF, with a muzzle velocity of 600 M (1968.5 feet) per second and a firing rate of 520 rounds per minute. The FF-K Oe 37 fired steel garnet (High Explosive) and Armor-Piercing (AP) shells.

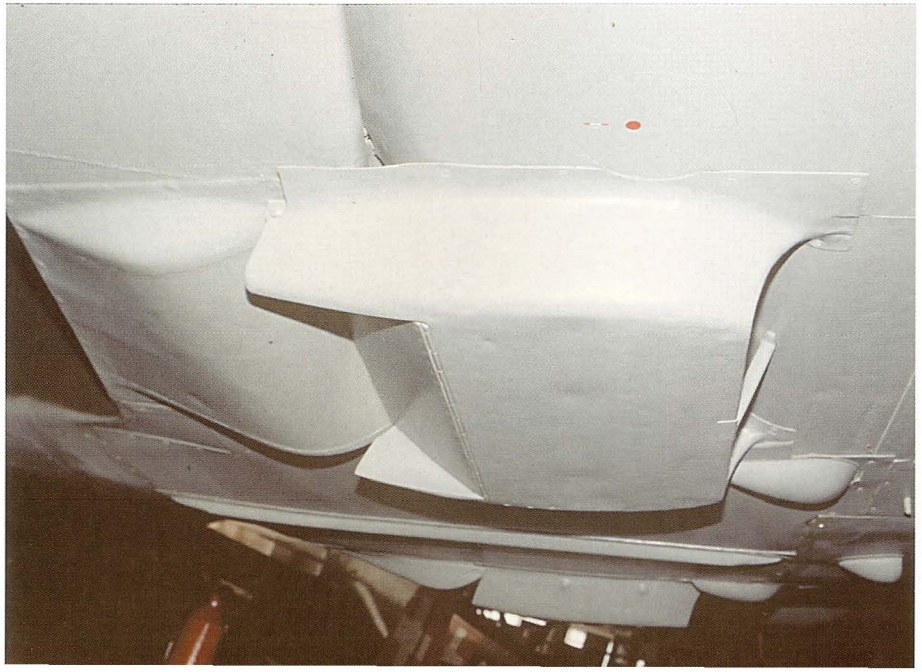


A blister on the upper surface wing root covered the connection bolt. This bolt secured the wing to the fuselage. This cover was removed to access the bolt, which was removed from the wing prior to the wing's removal from the fuselage for road transport.

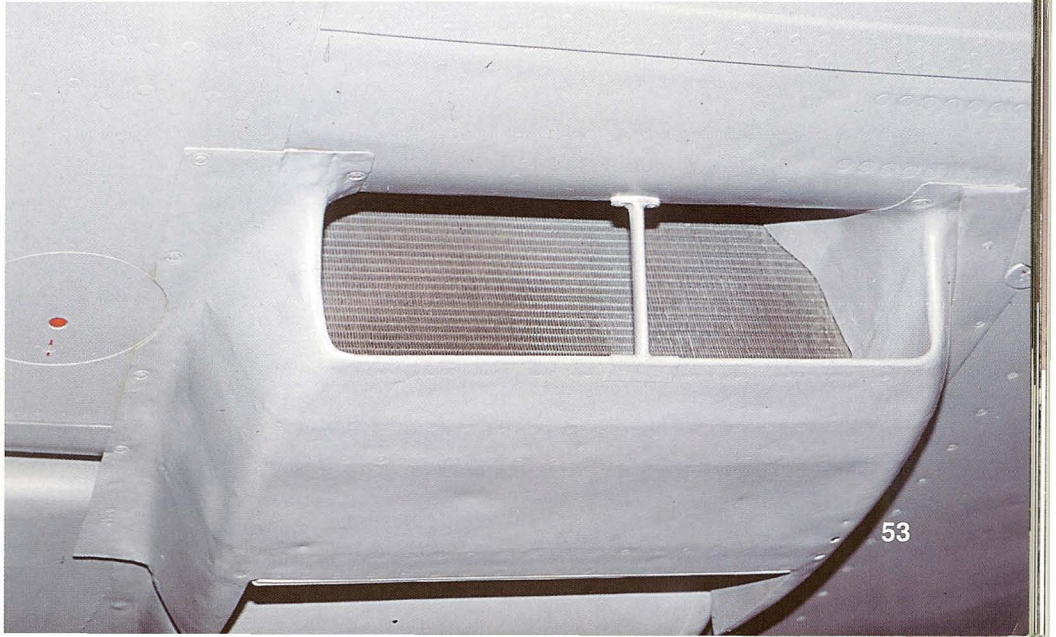


This hinge on the inboard lower wing surface connected the flap to the wing. The teardrop-shaped coverings were staggered, with the inboard half trailing the outboard covering. Another flap hinge was mounted near the wing root and was also given aerodynamic covers.

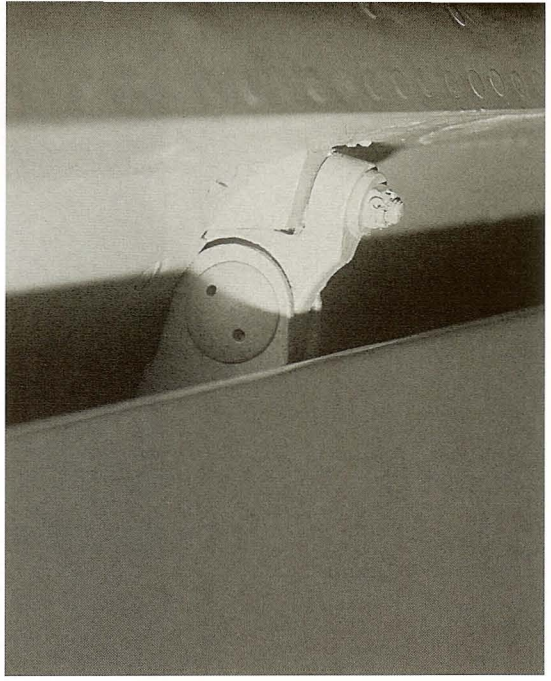
Two radiators for the DB 601A engine were mounted on the Bf 109E's wing undersurfaces. Both starboard (pictured) and port radiators were installed aft of the main landing gear bays. A large fairing attached to the radiator flap protected the fabric covering from heated air. It also reduced buffeting at various flap angles.



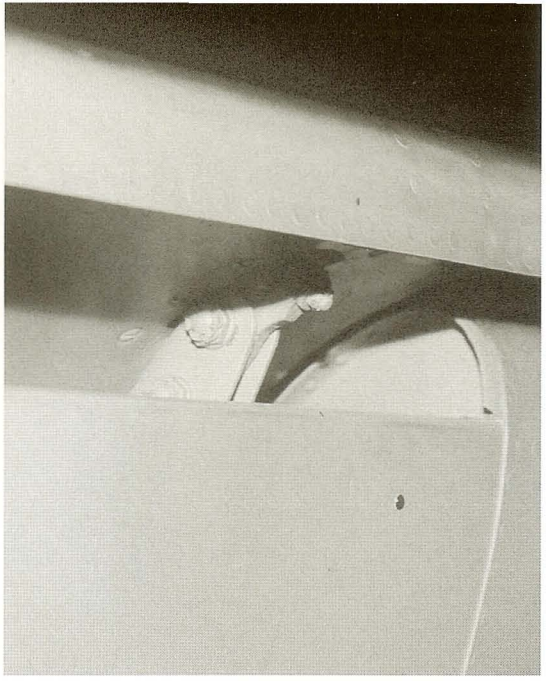
Each radiator was fed a mix of 50 percent ethylene glycol and 50 percent water during winter operations. This anti-freeze liquid assured safe operation at temperatures as low as -38° Celsius (-36° Fahrenheit), which was sufficient for the Swiss climate. This mixture often proved insufficient for Luftwaffe Emils operating in the severe winter conditions on the Eastern Front.



The port leading edge slat is fully extended on the Swiss Air Force Museum's Bf 109E-3. Each slat was built from Dural, an aluminum alloy, and had solid ribs riveted to it for strength. The slat's inner surface was painted to match the aircraft's undersurface color – in this case, RLM 65 Light Blue.

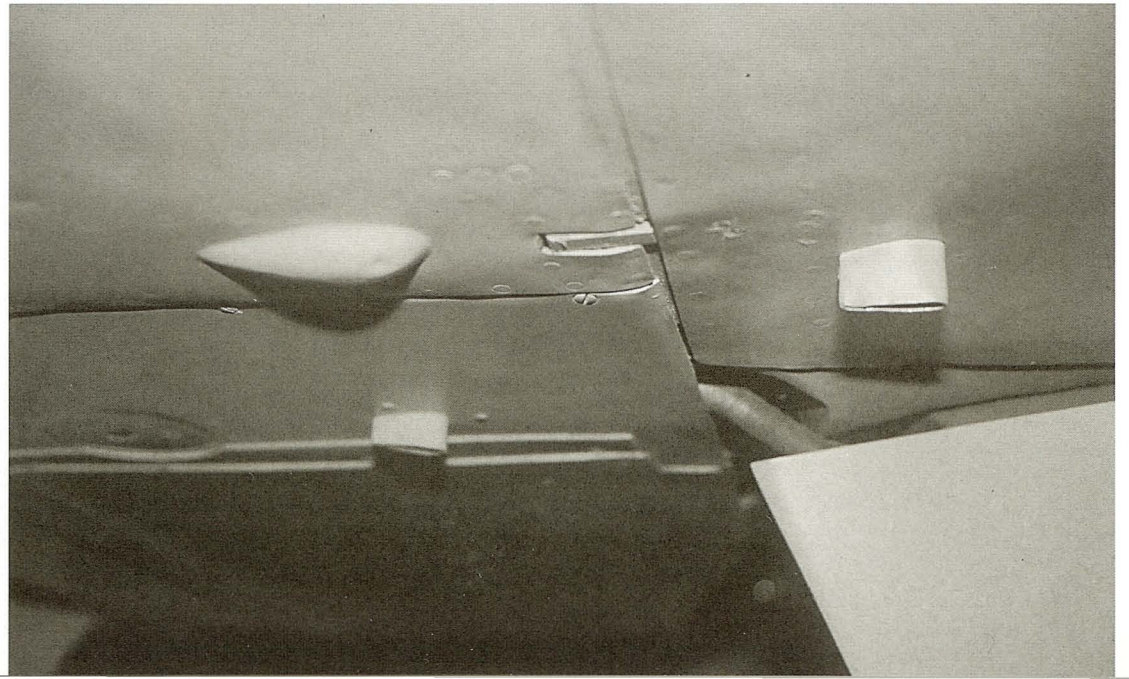


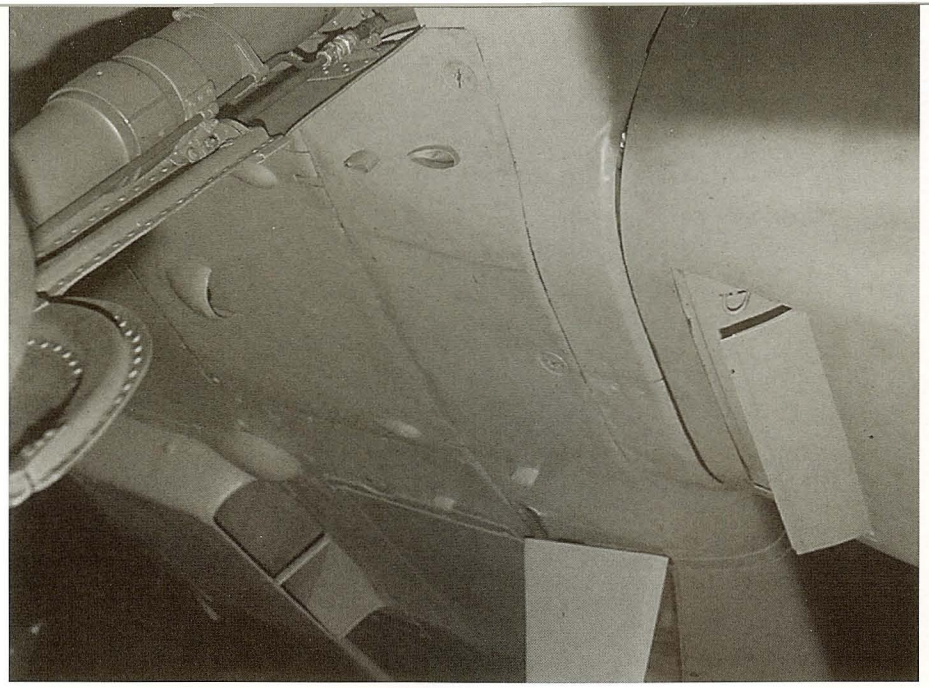
This outboard hinge connected the port leading edge slat with the wing. Two hinges connected each slat to the wing's leading edge.



The inboard slat hinge was identical to that of the outboard hinge. Both hinges acted in unison to extend or retract the slat, according to flight conditions.

A teardrop-shaped blister and two airfoil-shaped vents are located on the wing undersurface between the main landing gear wells. The blister's function is unknown; however, the two outlets vented excess fuel. These were used when the 400 L (106 gallon) fuel tank was filled beyond capacity or when the pilot needed to dump fuel prior to an emergency landing.





The main landing gear hydraulic system was accessed through a panel between the main gear bays. All Bf 109Es employed hydraulic landing gear operation. Three drop-shaped blisters and an inlet are located near this panel, along with the fuel overflow vents. Access and removal of the L-shaped fuselage fuel tank was through the large squared panel aft of the hydraulic system panel.

Two Swiss armorers install a 20MM ammunition magazine in the port wing of a Bf 109E-3 (J-328; *Werk Nummer* 2176). The circular hatch inboard of the 20MM FF-K Oe 37 cannon covered the aperture for the 7.92MM MG 17 machine gun installed on Bf 109E-1s. A circular lightening hole is located inside the wing cannon compartment. Two circular access plates are mounted near the ammunition magazine bulge. (Swiss Air Force Museum via Roland Küng)

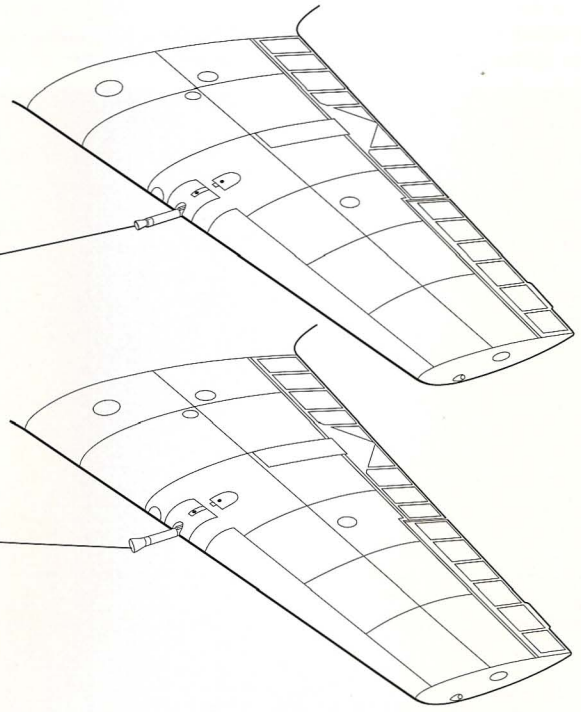
Bf 109E-3 Wing Armament

German

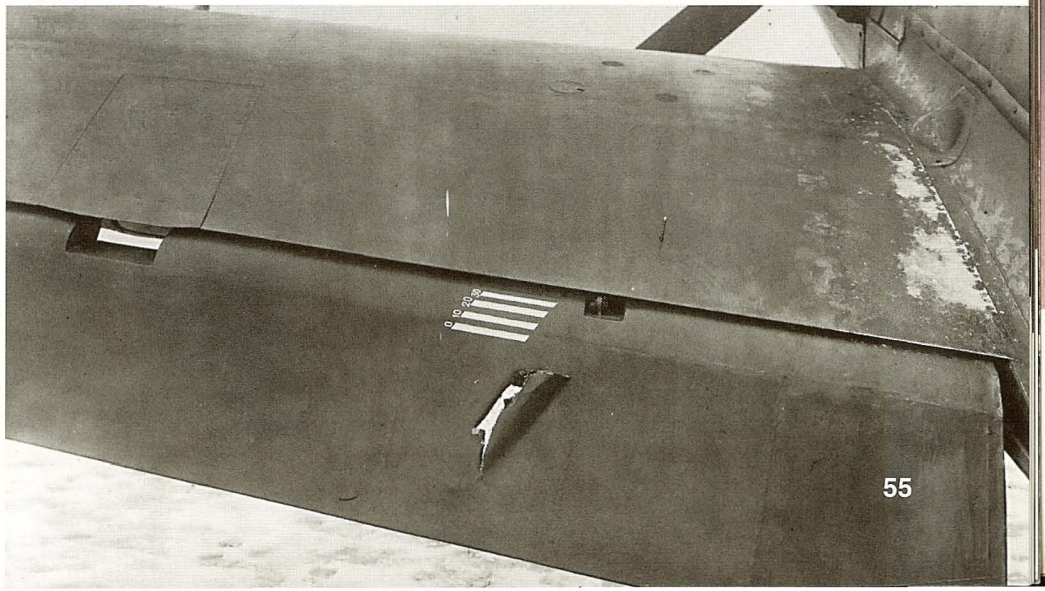
20MM Rheinmetall-Borsig MG FF Cannon with Conical Blast Tube (Built under license from Oerlikon)

Swiss

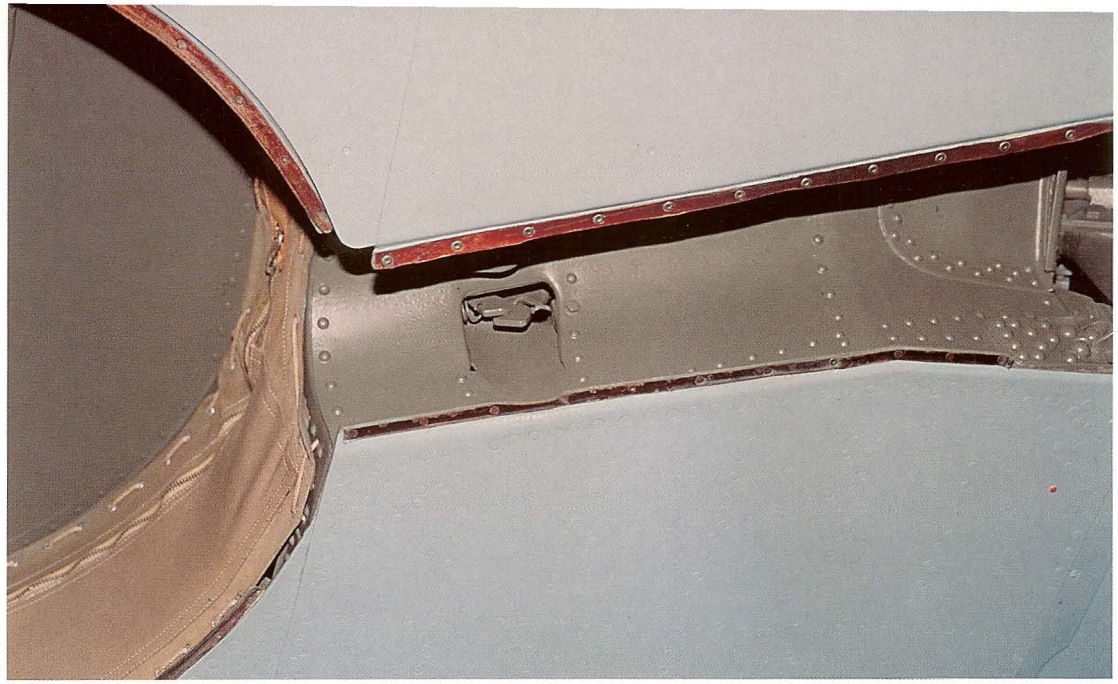
20MM Oerlikon FF K Oe 37 Cannon with Funnel-Shaped Blast Tube



The port flap is fully extended on this *Fliegertruppe* (Swiss Air Force) Bf 109E-3. There was a rip in the fabric covering of this flap. All *Emil* flaps had fabric-covered metal structures. White bars and numbers painted on the flaps indicated the degree of extension. Bf 109E flaps had a maximum deflection angle of 42°. The flap position indicator extended from the wing upper surface. (Swiss Air Force Museum via Roland Küng)

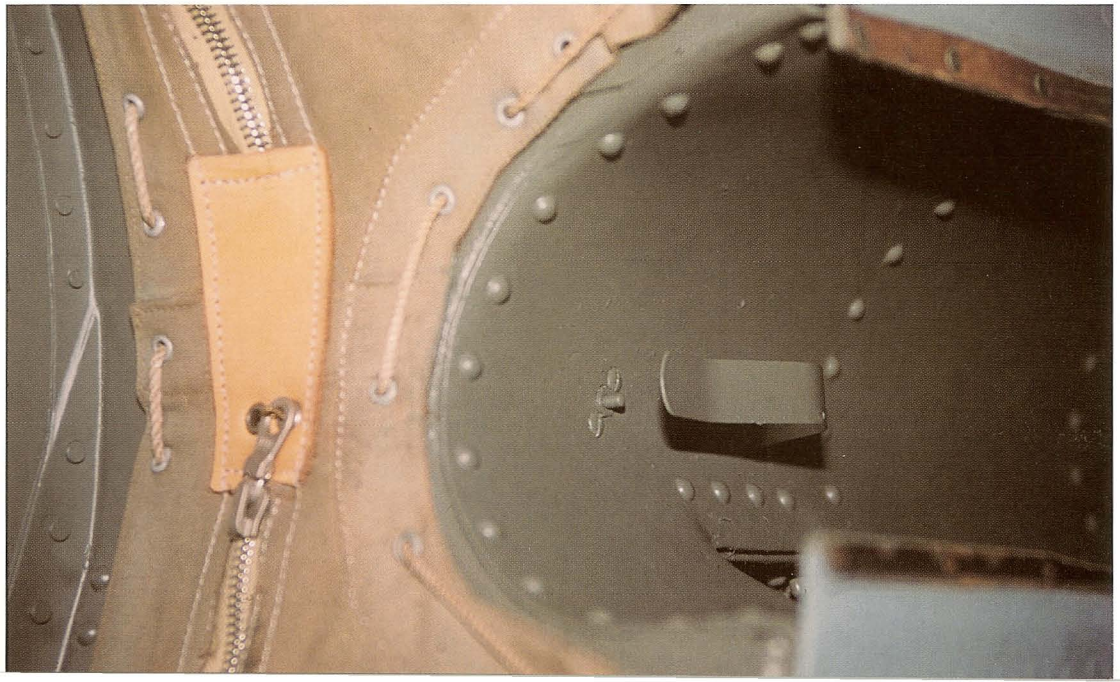


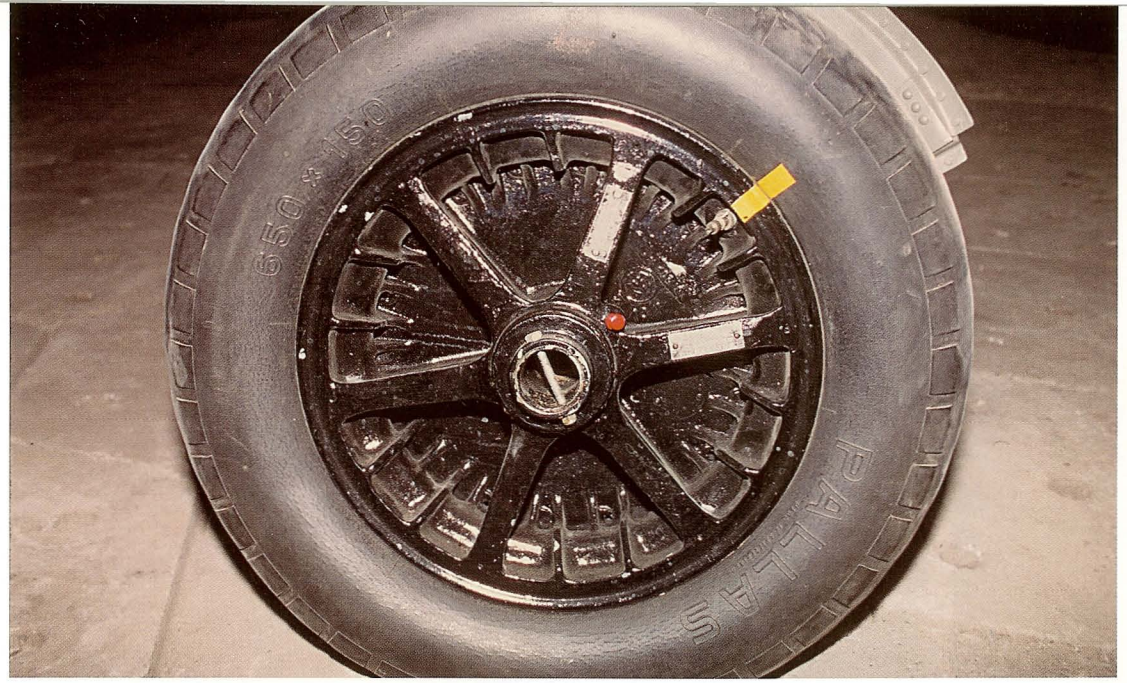
The Bf 109E-3's 2 M (6 foot 6.7 inch) undercarriage track made take-offs and landings rather hazardous undertakings. This track was actually wider than the Supermarine Spitfire's 1.75 M (5 foot 8.9 inch) track. The *Emil*'s landing gear and brakes were hydraulically operated using an engine-driven pump. Hydraulic fluid was supplied from an accumulator tank ahead of the forward fuselage bulkhead.



The landing gear strut was retracted into a metal-lined channel and was enclosed by a two-part door attached to the strut. The Swiss Bf 109E-3's main landing gear well displays the fine workmanship in its riveting. Bf 109E landing gear wells, gear door inner surfaces, and gear struts were usually painted RLM 02 RLM Gray (FS36165).

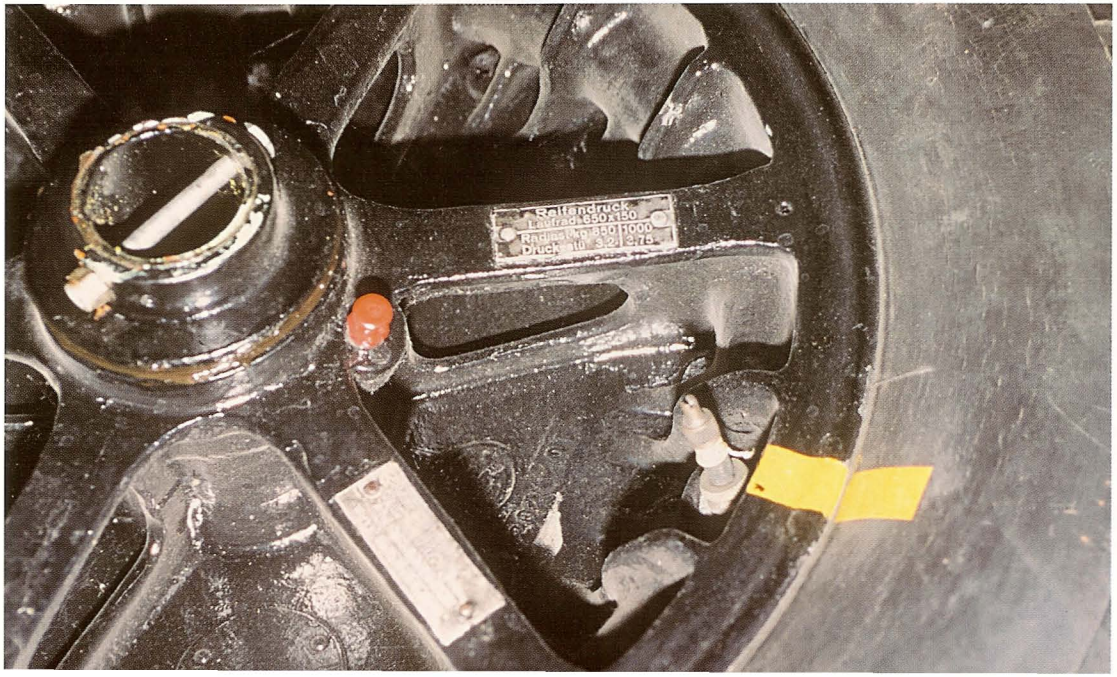
A leather or canvas cover was placed around the well perimeter and was zipped open for quick wing interior inspection. Swiss Bf 109Es used leather covers for the well perimeter.

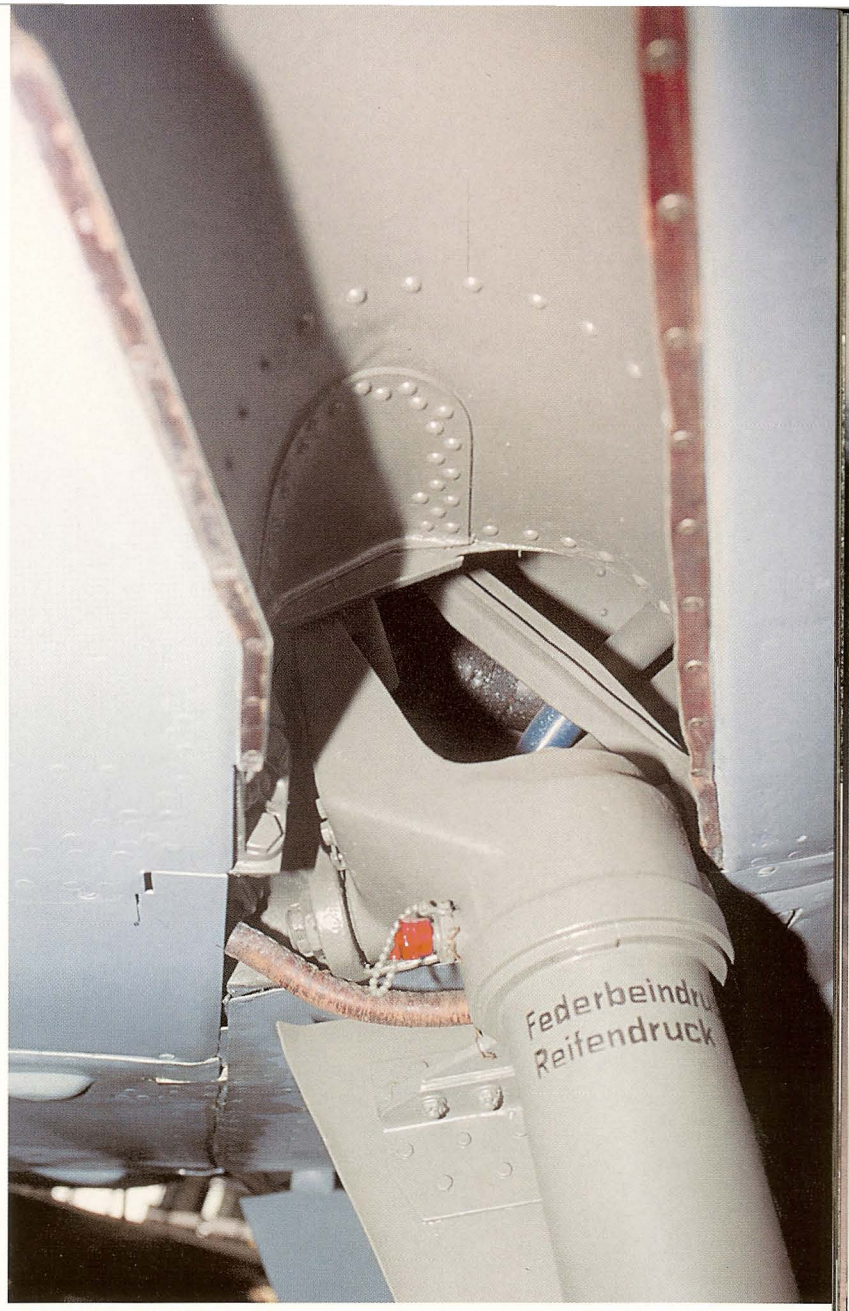




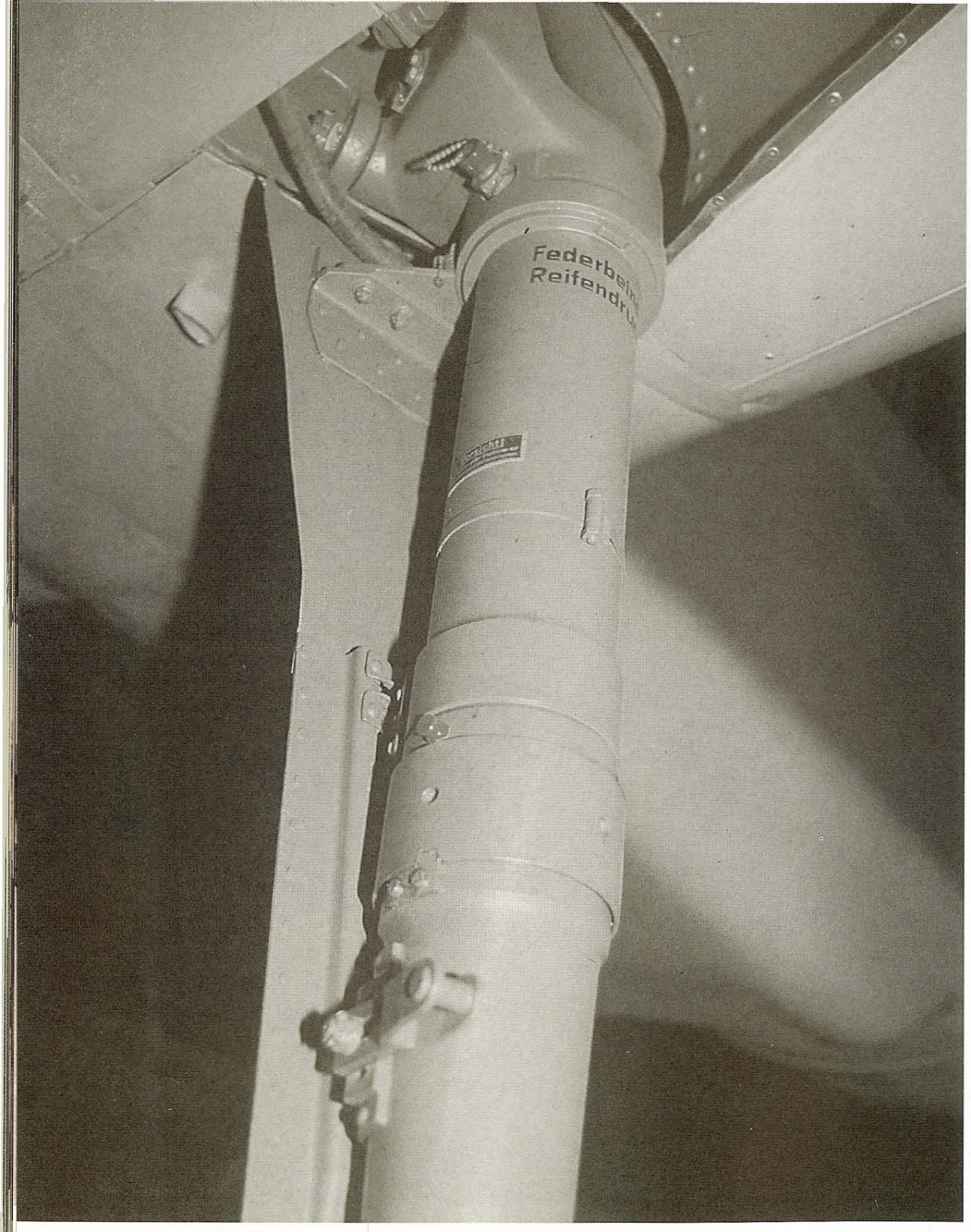
Each Bf 109E-3 main wheel had a Continental tire, which measured 650MM (25.6 inches) in diameter by 150MM (5.9 inches) in width. The tire was inflated to a pressure of 4.5 atmospheres (66 PSI). *Emils* used six-spoked main wheels, which were time consuming to produce and were replaced by simpler wheels on later Bf 109 variants.

Two small data plates are riveted to the Bf 109E-3's main wheel spokes. The tire's air inflation valve was marked with a Yellow stripe on the adjoining wheel rim and tire. This Yellow stripe also indicated tire slippage. Bf 109E main wheels were painted glossy black.

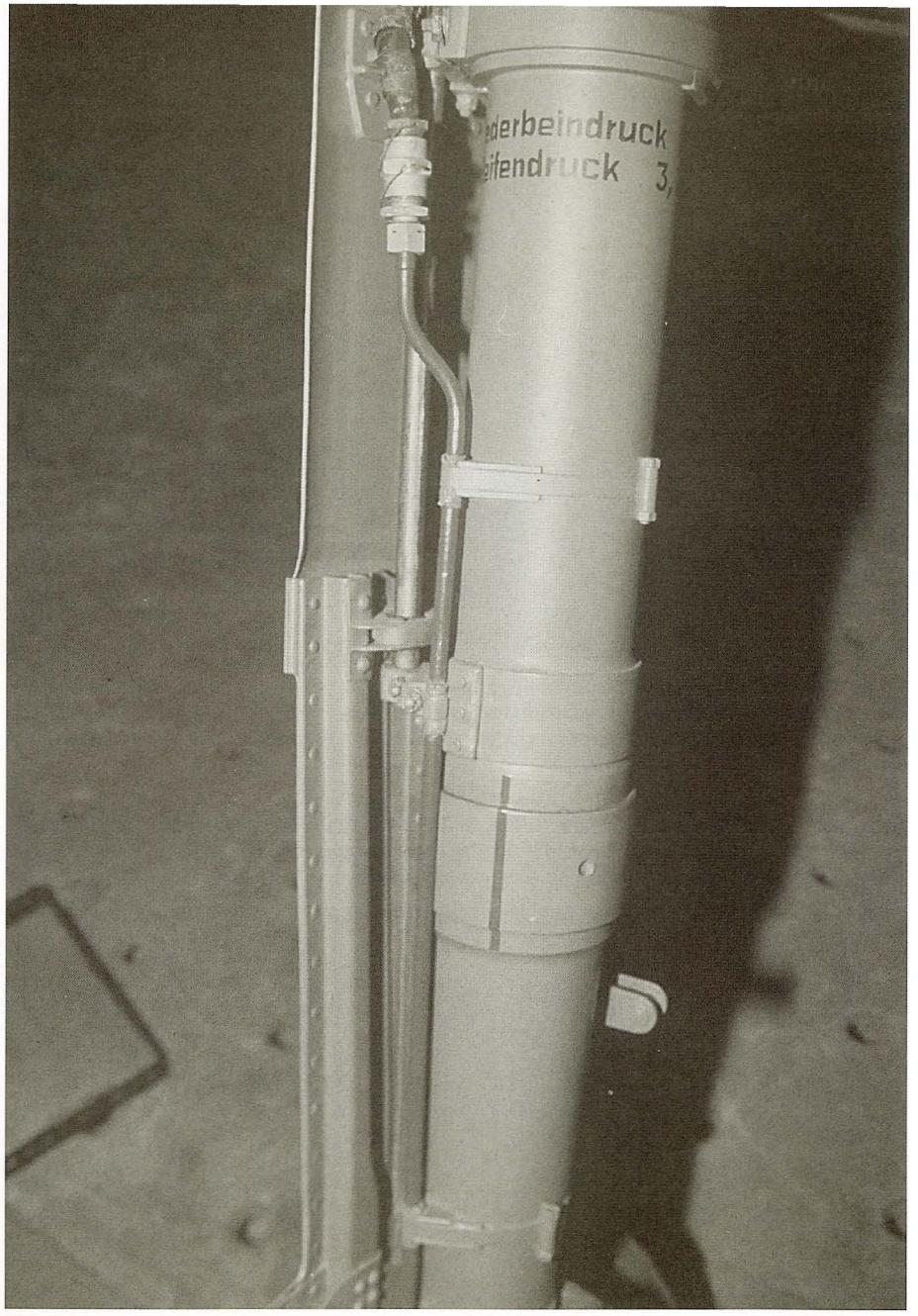




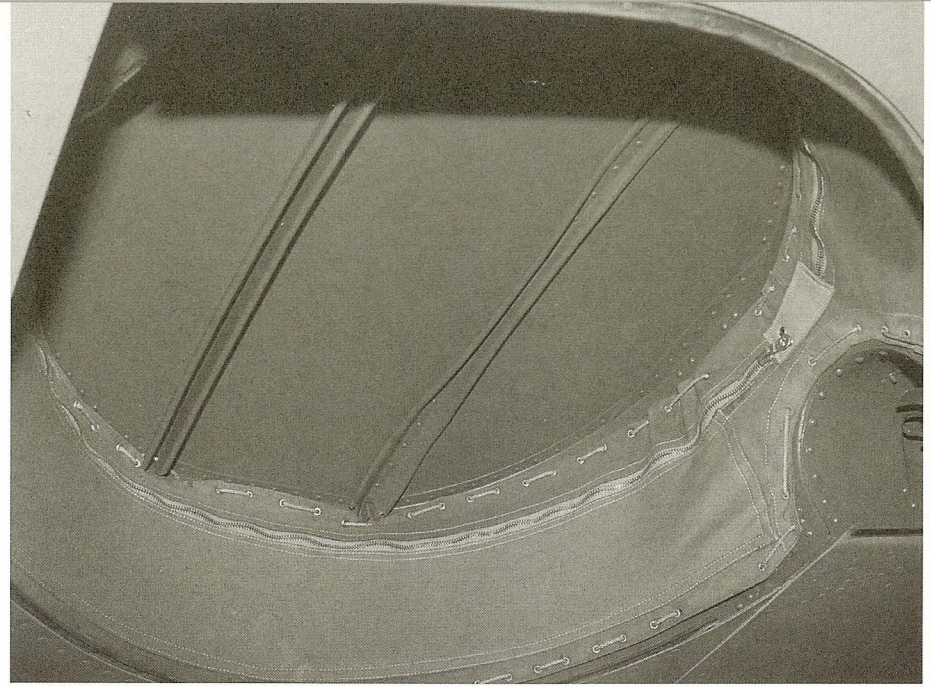
The main landing gear strut hinge point was located on the fuselage. This allowed aerodynamic loads to be directly transferred into the main structure, which relieved the wing of pressure and allowed for a lighter wing structure. *Federbeindruck* (oleo strut pneumatic pressure) and *Reifendruck* (tire air pressure) are painted in Black on the gear leg.



The main landing gear strut was fitted to a forged steel attachment mounted to the fuselage. Each strut employed internal oleo (shock absorbing) units, which were filled with air and equipped with hydraulic oil damping for energy absorption. An RLM 26 Brown (FS30109) hydraulic fluid pipe ran from the gear bay down the strut leg. RLM 23 Red (FS31140) rings on this piping indicated hydraulic oil.

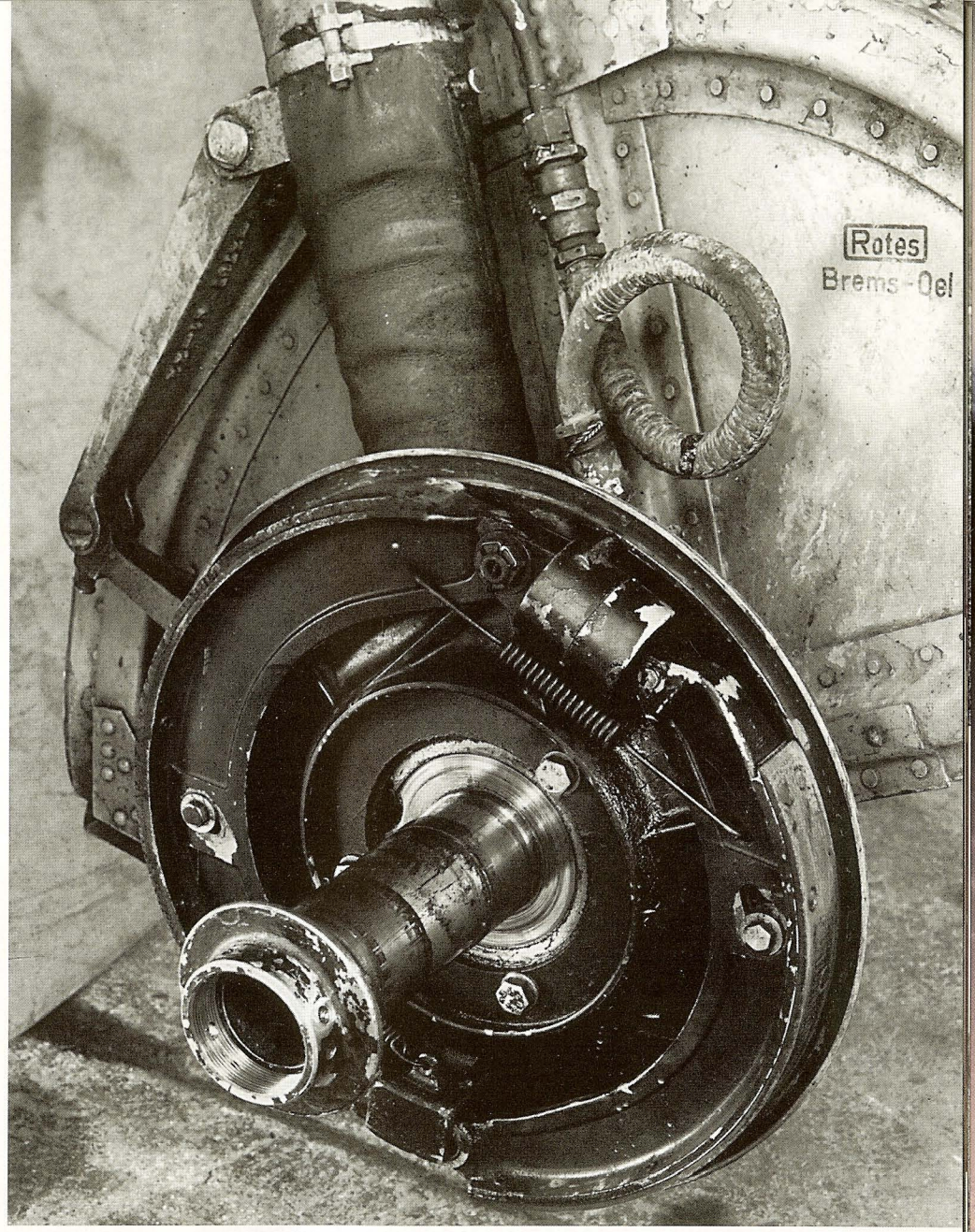


The hydraulic line ran down the front of the Bf 109E's main landing gear strut. This carried hydraulic fluid to the brakes fitted within the wheels. The long fairing cover is attached to the gear leg. This cover's lower section was removed for inspection of the brakes and wheel. Both the gear leg and the gear door inner surface were painted RLM 02 RLM Gray.

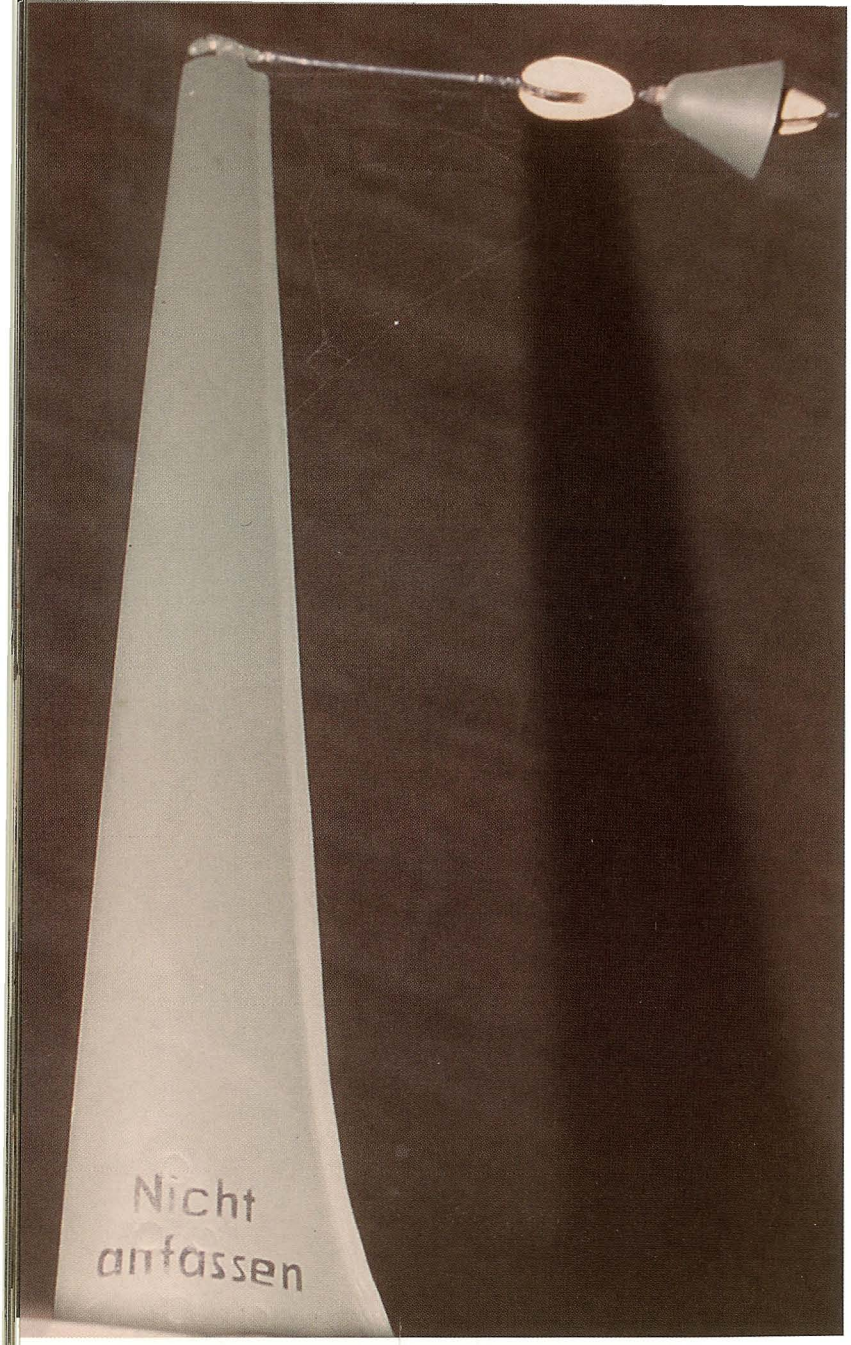


A natural leather cover is installed around the main wheel well perimeter. This protected the inner wing structure from Foreign Object Damage (FOD), such as mud and rocks. Two stabilization ribs are fitted to the well's upper surface for greater strength.

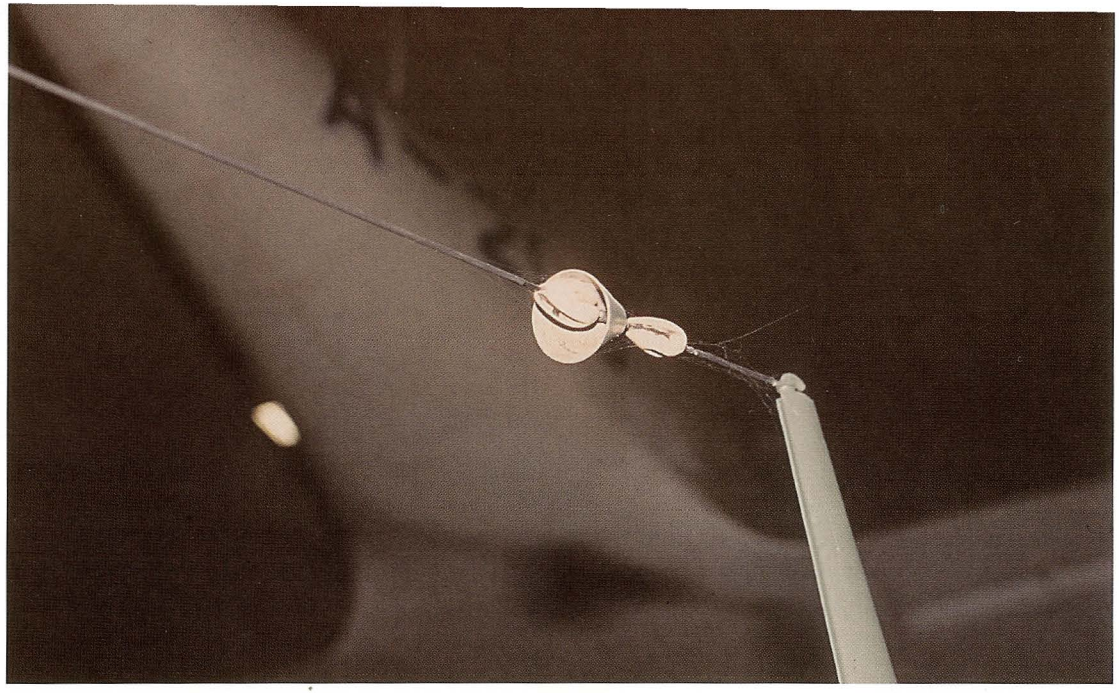
This main wheel strut was damaged during a hard landing, which resulted in tearing of a few main wheel well panels. The rubber hoses inboard of the strut carried coolant from the engine to the wing-mounted radiators. (Swiss Air Force Museum via Roland Küng)



The main wheel has been removed from the strut of this Bf 109E. Hydraulically-operated brakes were installed in each main wheel. The pilot operated the brakes by pressing on the rudder pedals, and each brake was operated separately. The hydraulic pipe ran down the strut's front and curled beside the wheel. This flexibility allowed the hose to move with the oleo. A leather cover is fitted over the lower strut section. This cover was removed for servicing this strut. (Swiss Air Force Museum via Roland Küng)

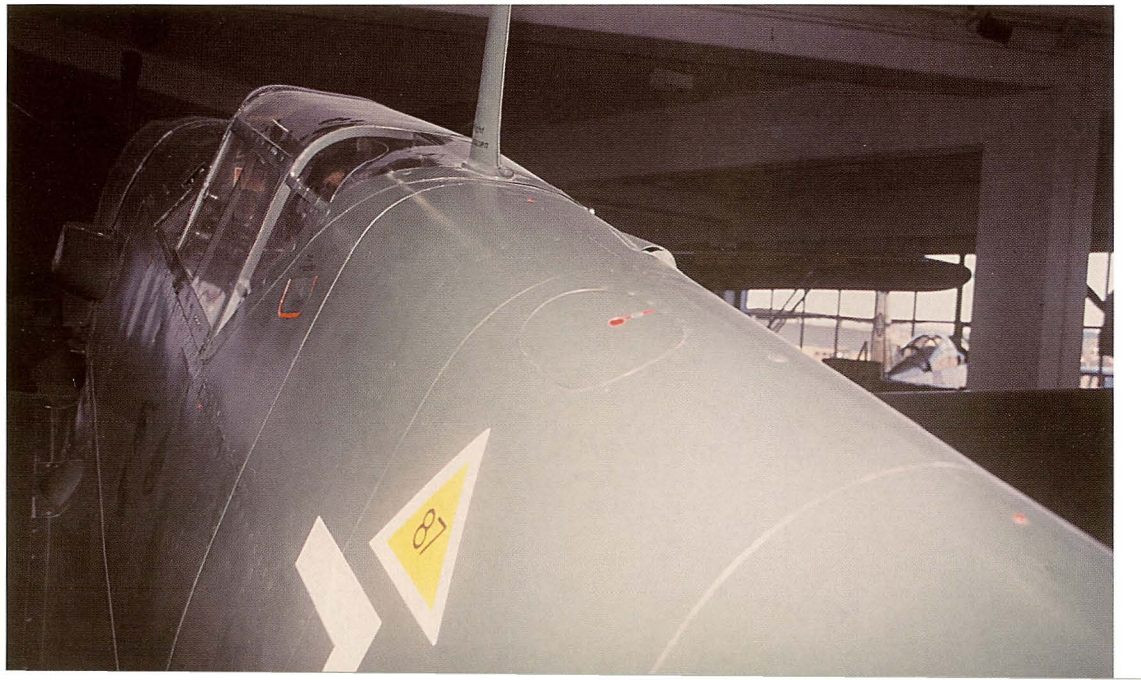


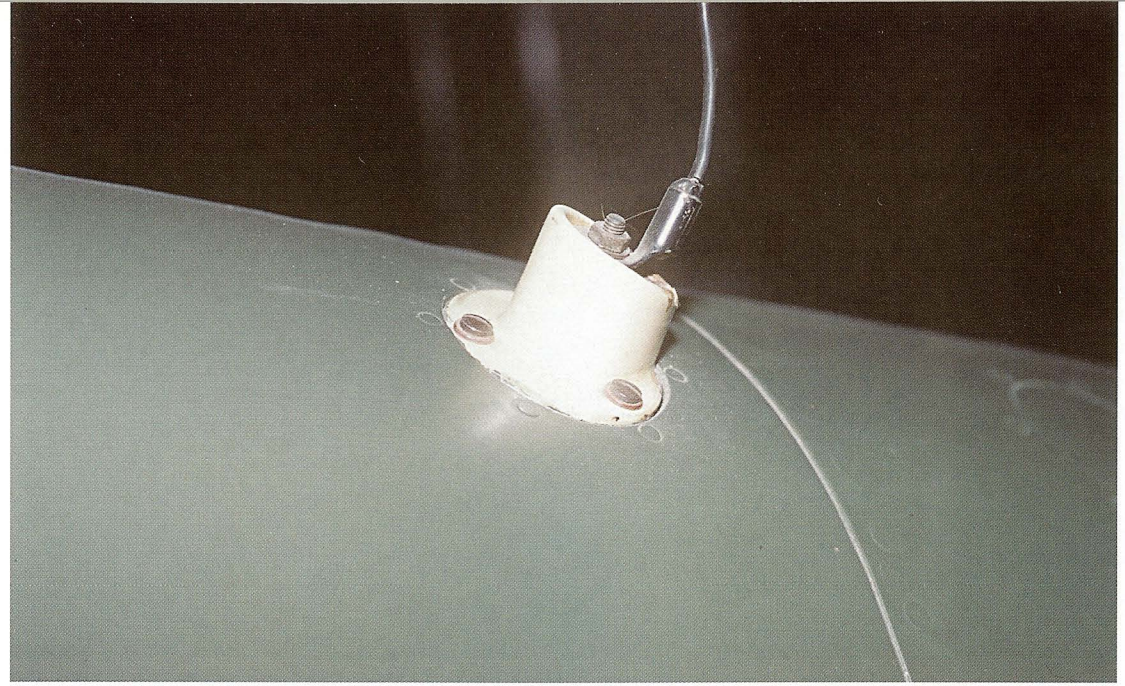
All Bf 109Es – including the Swiss Air Force Museum's Bf 109E-3 – had an antenna mast located on the upper fuselage immediately aft of the canopy. *Nicht anfassen* (Do not touch) is painted in Black at the mast's base. This example has the correct insulator configuration on the antenna cable.



The forward antenna cable end enters a funnel-shaped covering aft of the mast. A Bakelite plastic insulator immediately forward of the funnel ensure that the cable is not connected with other metal airframe parts.

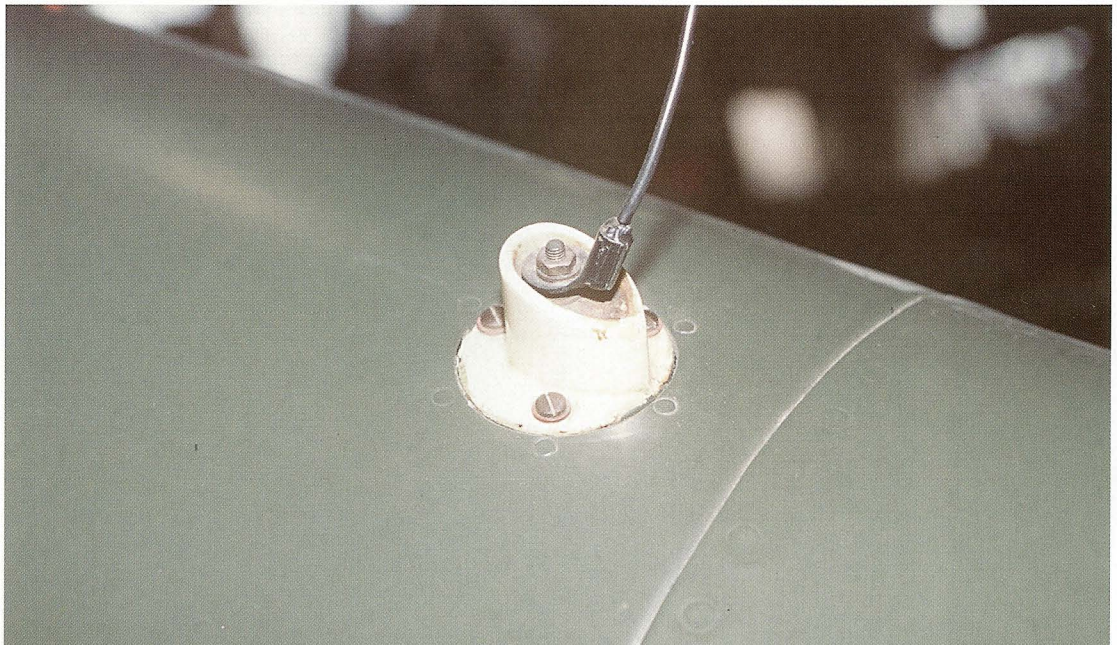
An oval fuel tank filling hatch is mounted on the upper fuselage, aft of the cockpit. The Black number 87 inside the RLM 04 Yellow triangle indicated the required octane of fuel. A 400 L (106 gallon) L-shaped fuel tank was installed aft of and beneath the pilot's seat. This rubber-covered metal tank was not self-sealing and was vulnerable to explosions when hit by gunfire. The tank vented to the filler cavity, which had an overflow pipe running down to the lower fuselage. (Walter Hodel)

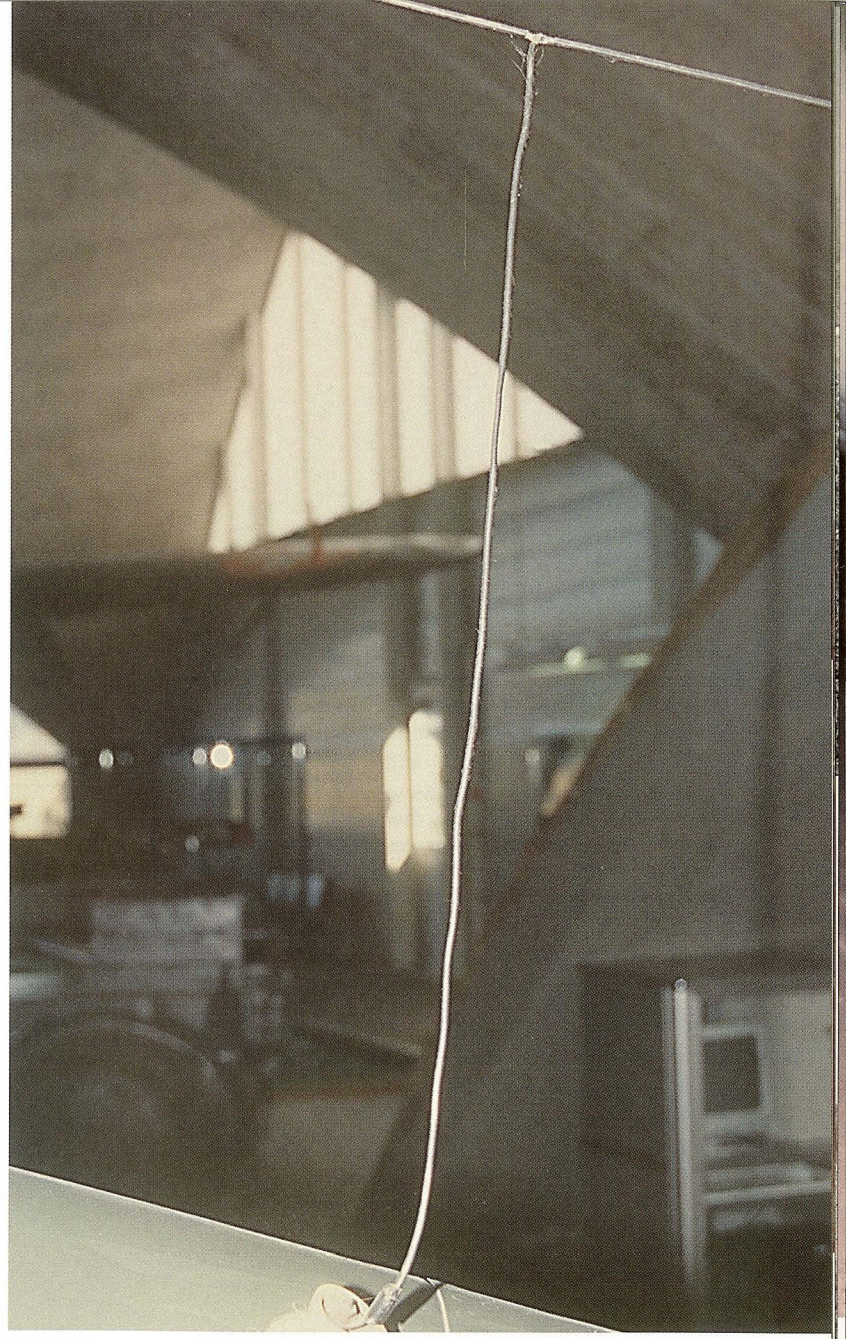




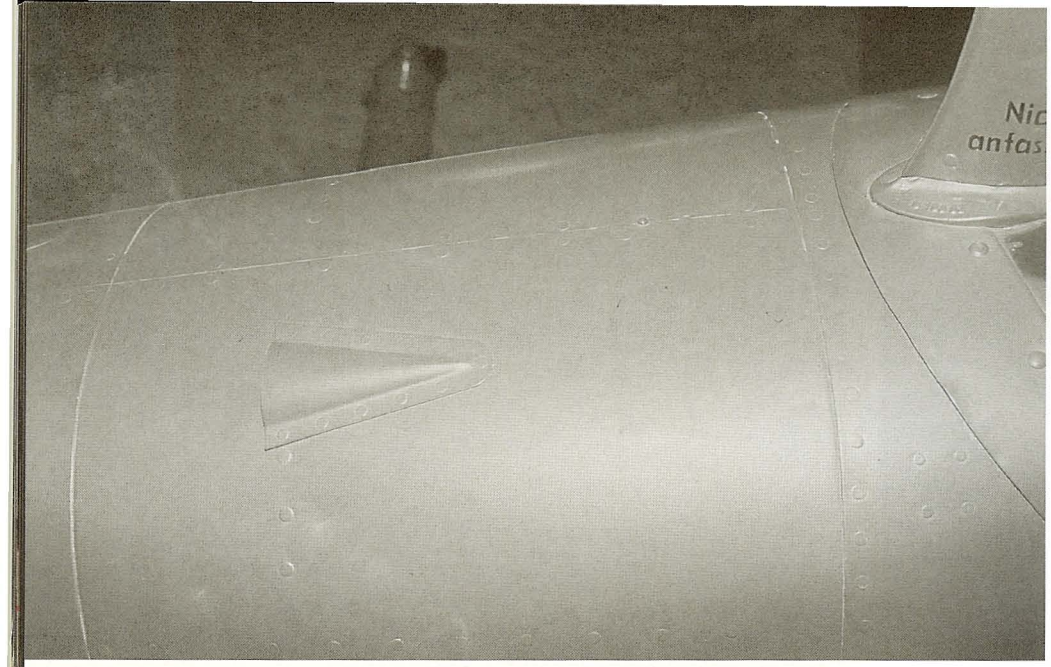
The antenna lead-in cable runs from the main cable into the rear starboard fuselage. A white Bakelite fairing in the fuselage prevented the cable from making any contact with other metal airframe parts. Screws secured this fairing into the upper fuselage. This fairing was mounted 18 CM (7.1 inches) in front of the original German position. The circular plate for the original fairing position is located aft of the Swiss fairing. Different radio equipment positions in German and Swiss Bf 109Es required this change in lead-in fairing position.

The antenna lead-in cable slants slightly to port of the centerline where it enters the fuselage. The Swiss used French-built SIF 450 radios on some of their Bf 109E-3s in place of the Telefunken FuG VII radios on German *Emils*. Other Swiss Bf 109E-3s lacked radios.

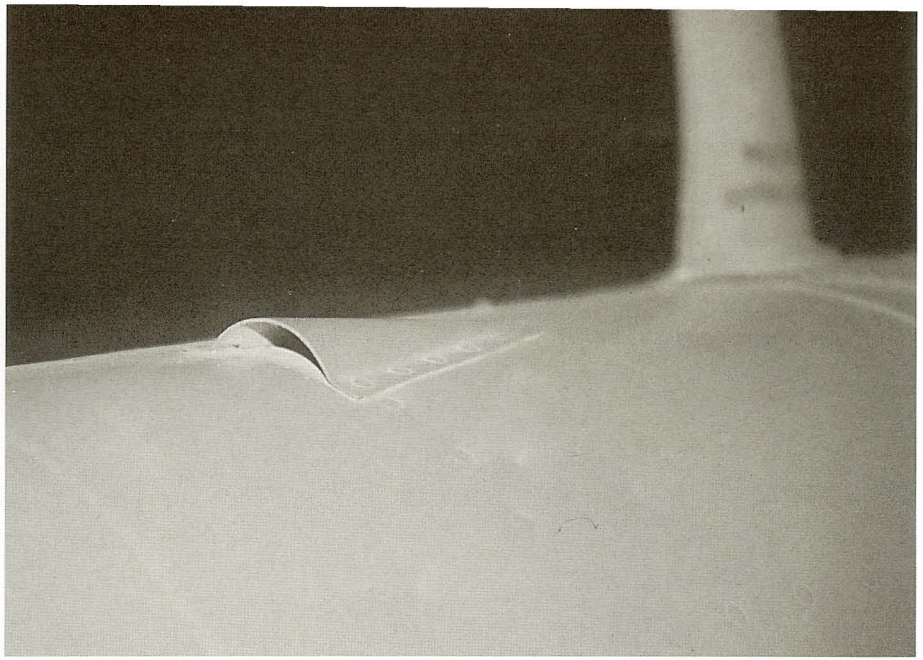




Swiss Bf 109E-3s had identical antenna cable layouts to German *Emils*. These aircraft differed only in the equipment they carried. The main cable was strung from the mid-fuselage antenna mast to a mast atop the vertical stabilizer. The shorter lead-in cable ran down from the main cable to the radio set inside the fuselage. (Walter Hodel)



A ventilation outlet on the starboard upper fuselage was added to all Swiss *Fliegertruppe* Bf 109s in approximately 1941. This feature – unique to Swiss *Emils* – vented gases from the battery compartment located in the aft fuselage.

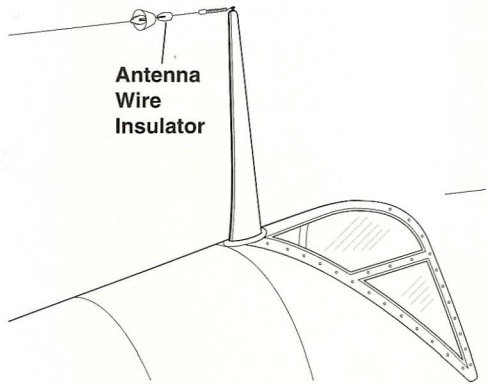


The battery gas outlet was only installed on the Bf 109E-3's starboard upper fuselage, not on the port side. Although technically correct for Swiss *Emils* from 1941 onward, it is incorrect for an aircraft painted in the 1940 scheme. Late World War Two Swiss Bf 109E-3s also had prominent Red and White neutrality markings and small fuselage registrations.

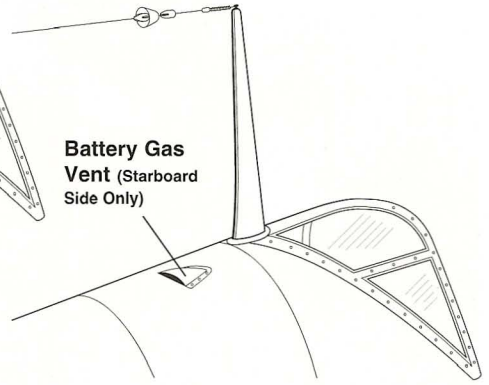
Two *Fliegertruppe* mechanics service a Bf 109E-3 at its airfield. A tarpaulin covers the highly visible Red and White Swiss national markings on the fuselage of the near aircraft and on the wings and fuselage of an *Emil* in the background. The Yellow R on the near aircraft indicated it is equipped with a radio. Only a minority of Swiss *Emils* were radio-equipped early in World War Two. (Swiss Air Force Museum via Roland Küng)

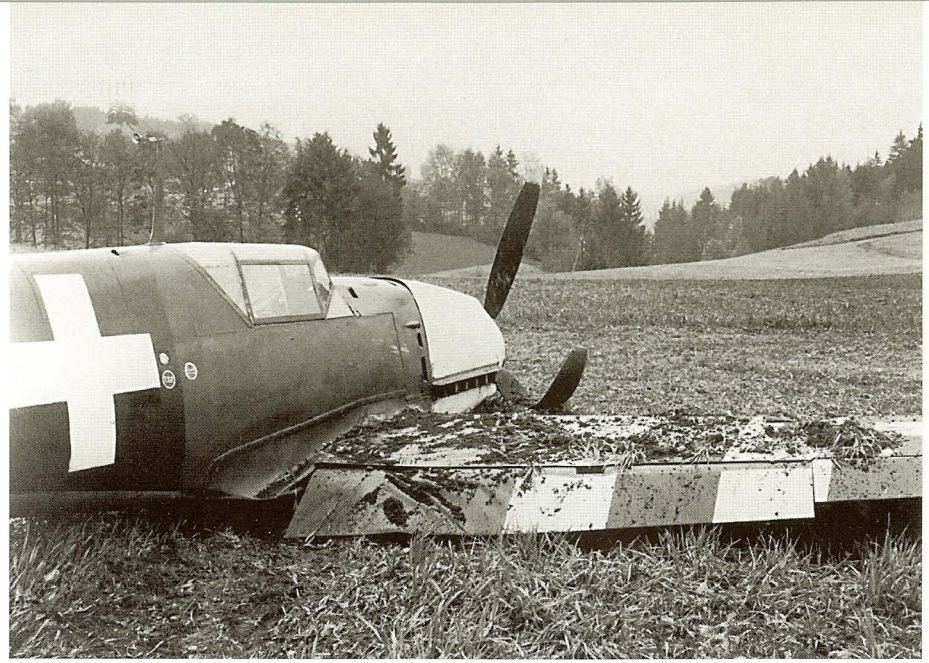
Bf 109E-3 Antenna Area Development

German and Swiss (Early)



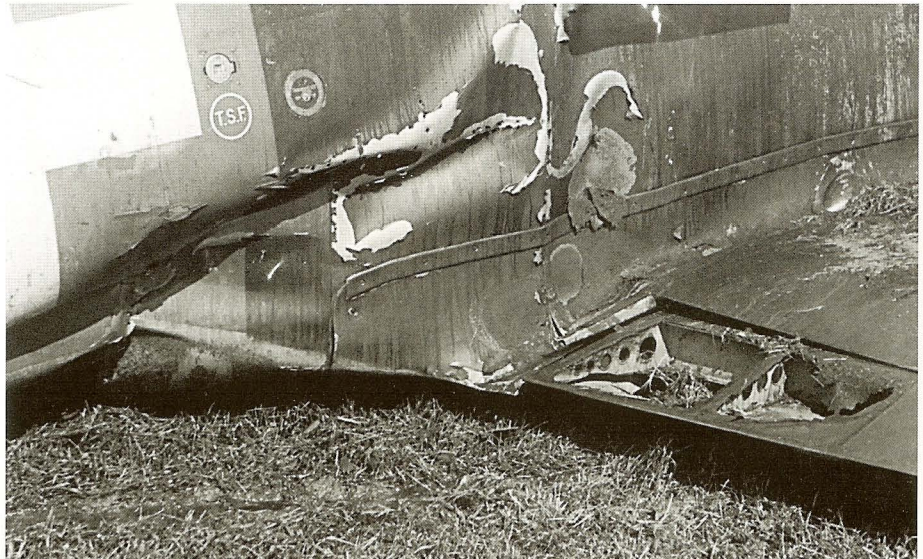
Swiss (Late)

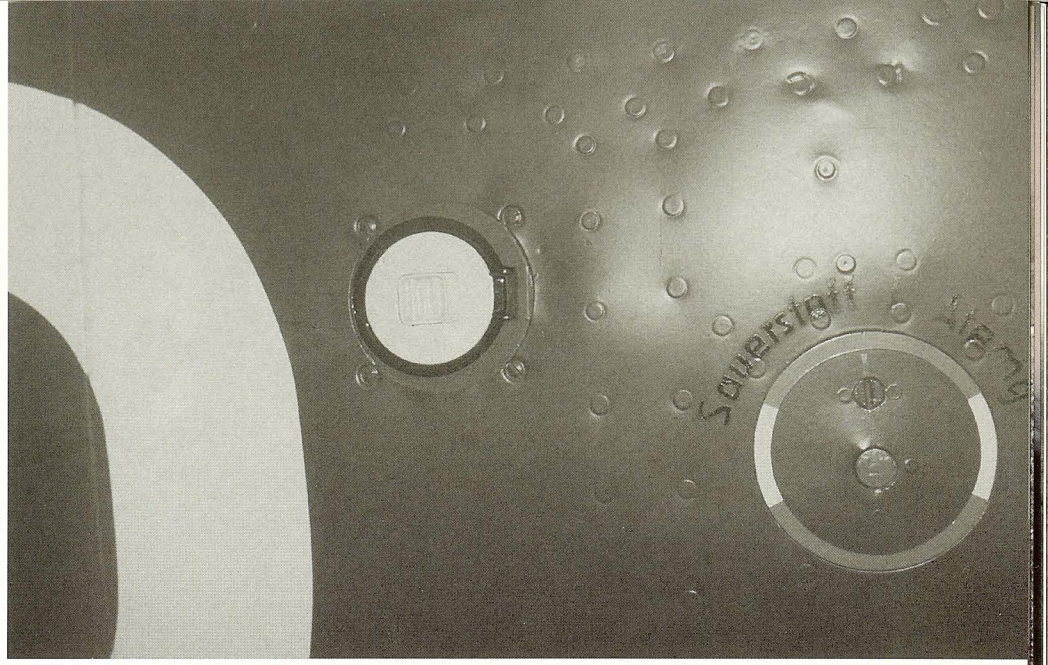




This Bf 109E-3 (J-358; *Werk Nummer* 2425) made a wheels-up landing due to an engine malfunction at Uetendorf, Canton of Berne on 23 October 1944. Large White and Red neutrality markings were ordered painted on the wings and fuselage of *Fliegertruppe* Bf 109E-3s from 15 September 1944. The external power supply socket is located immediately forward of the Swiss cross, while the oxygen filler panel is in front of this socket. Both features were also included on all German *Emils*. (Swiss Air Force Museum via Roland Küng)

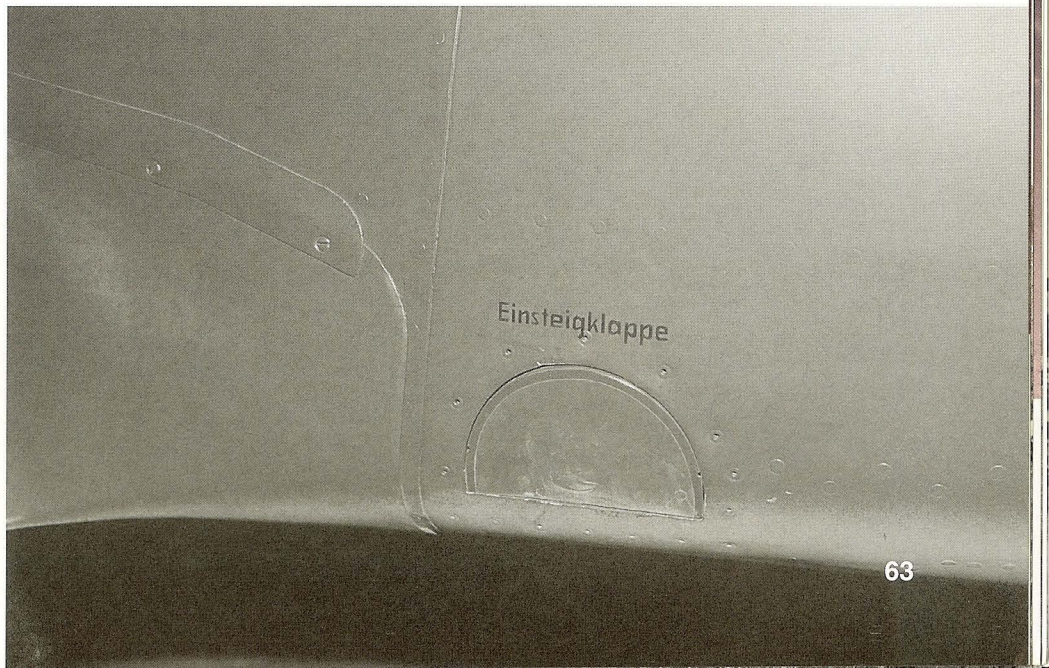
Two 339th Fighter Group P-51D Mustangs shot down this Bf 109E (J-324; *Werk Nummer* 2172) on 5 September 1944. *Oberleutnant* (1st Lieutenant) Robert Heiniger of *Flieger Kompagnie* 7 (7th Flight Company) survived this attack and belly-landed his *Emil* at Dübendorf. Highly visible neutrality markings were painted on Swiss aircraft after this incident. Access hatches for the external power-supply socket (left) and oxygen filler point are located on the fuselage side. (Swiss Air Force Museum via Roland Küng)

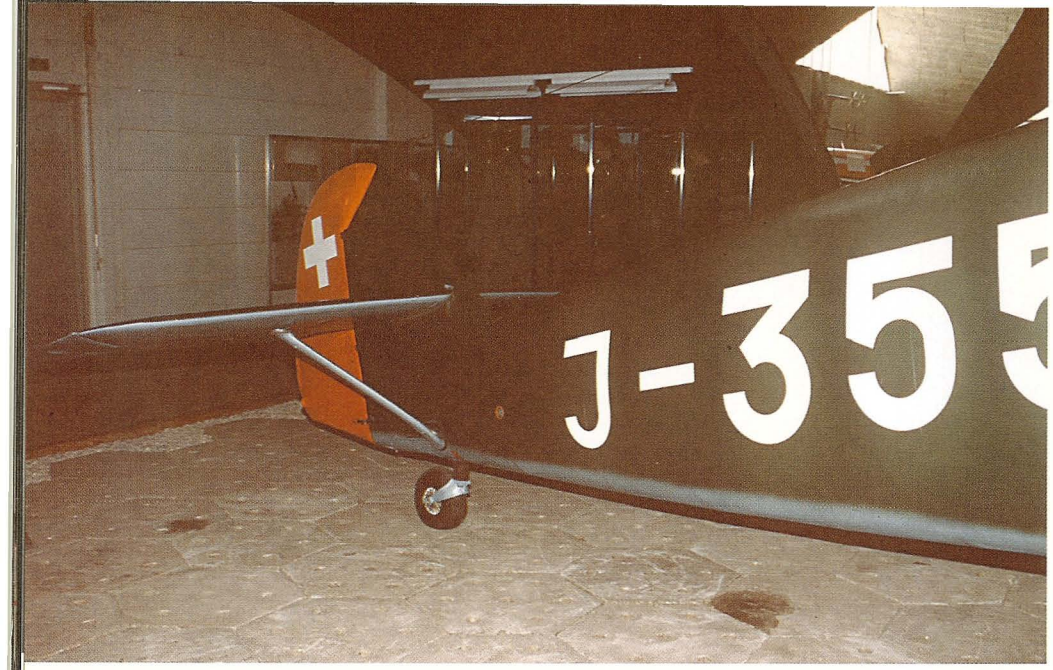


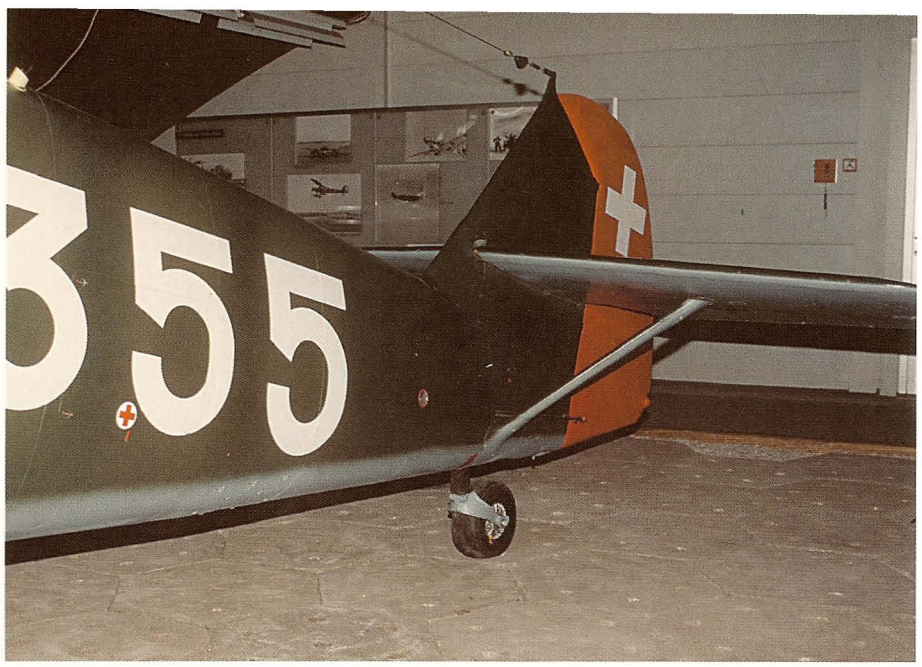


The Light Blue and White oxygen filler hatch was mounted on the starboard fuselage, just aft of the cockpit. *Sauerstoff f. Atemgerät* (Oxygen for Breathing Equipment) is painted in Black above this flush-mounted hatch. The White-covered external power-supply socket is located aft of the oxygen filler hatch. This socket normally had a Red cover on Luftwaffe aircraft.

A Red-outlined footstep cover is mounted on the port lower fuselage, near the wing root. This spring-loaded door was hinged at the bottom and enclosed a footstep used to climb on and off the Bf 109E-3. *Einsteigklappe* (Stepboard) in Black is painted immediately above the cover on this preserved Swiss *Emil*.





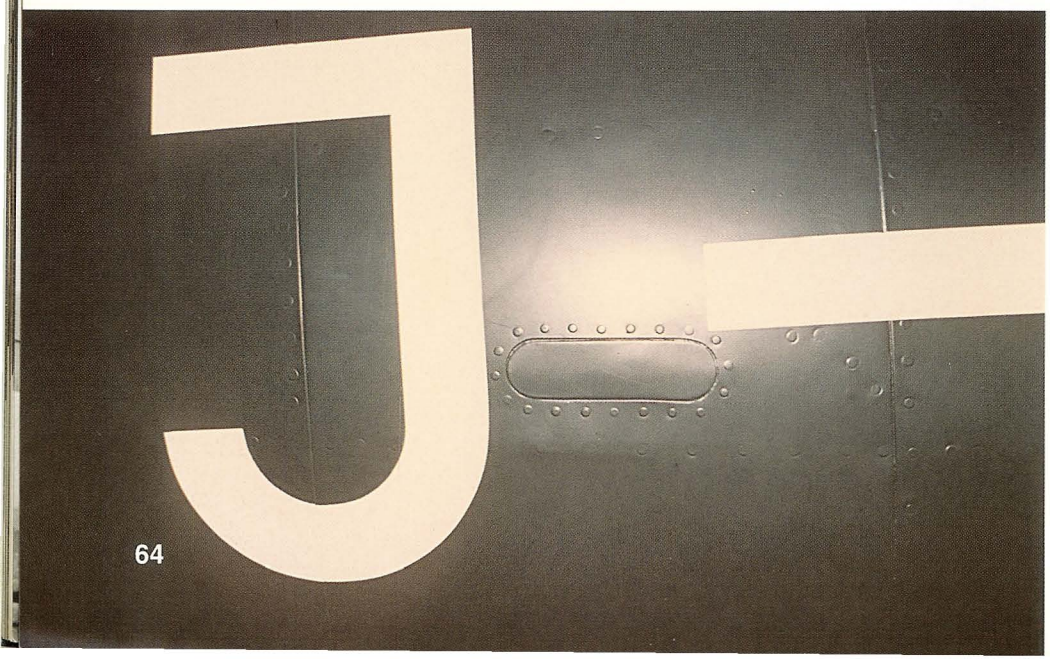


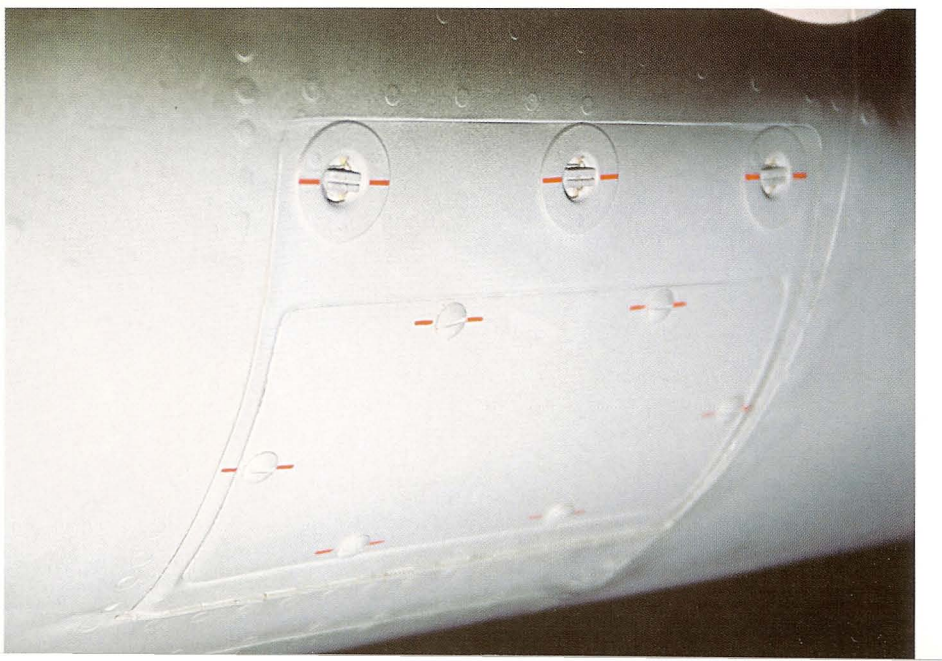
The Swiss Air Force Museum's Bf 109E-3 (J-355) is displayed at Dübendorf in 1940 markings. Large White registrations were painted on the aft fuselage of *Fliegertruppe Emils* between their delivery from Germany and April of 1940. The J (*Jagd*; Fighter) prefix was always painted smaller than the numbers. Swiss *Emils* were coded in the J-311 to J-390 range.

The access hatch for both the first aid kit and the radio compartment was mounted only on the port aft fuselage. Four flush mounted screws, one in each corner, secured this hatch to the fuselage. The lifting bar insertion aperture is located further aft on the fuselage side.

This narrow panel on the rear starboard side housed flare cassettes on Bf 109E-3s. It is covered by a sheet metal fairing on this restored aircraft. Flares were used for communication under radio silence conditions or if the radio was not functioning. The Swiss *Fliegertruppe* employed these flares on their *Emils*.

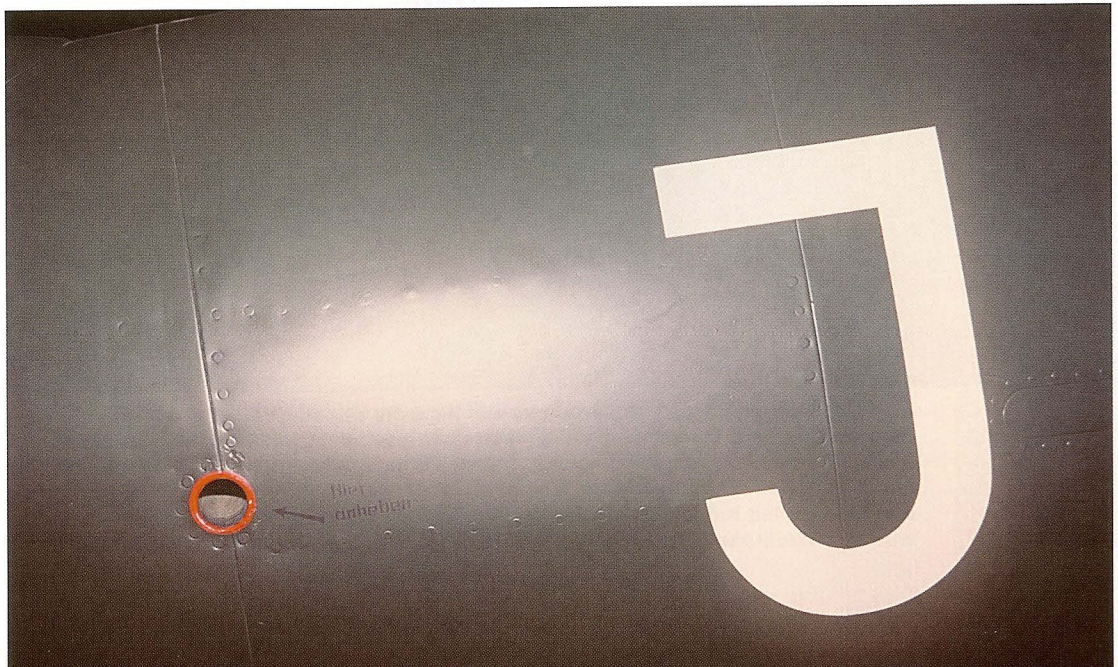
An access hatch was mounted on the lower rear fuselage. This panel is unusual as it has no snap-fit access, but is attached with quarter-turn fasteners. Most Bf 109E access panels used the snap-fit system. Red lines on the fuselage indicated the proper screw slot position for a closed panel.

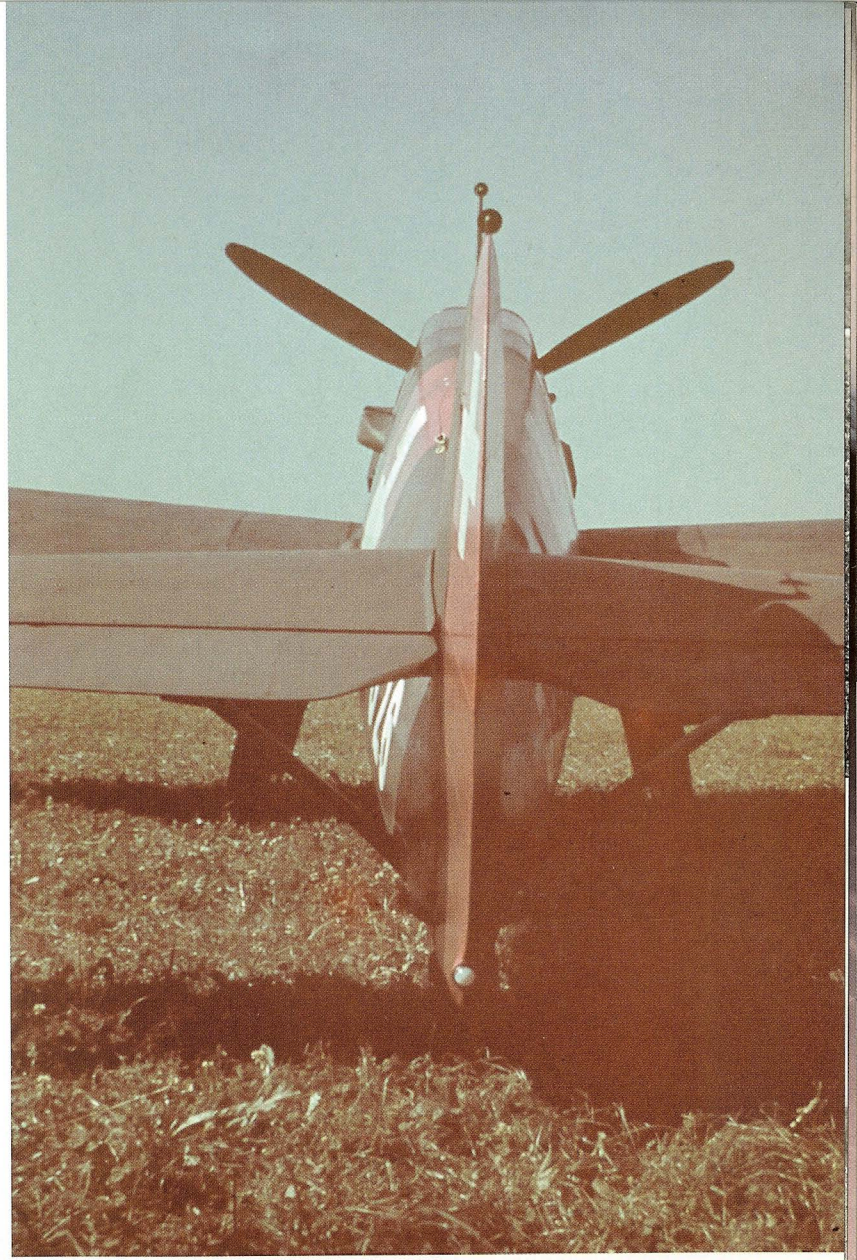




All Bf 109Es had a first aid and radio compartment on the port aft fuselage. The rectangular hatch was secured using a quarter-turn fastener in each corner. Both German and Swiss *Emils* used the internationally recognized Red Cross insignia on this rectangular hatch to indicate the first aid kit location. Swiss citizen Henri Dunant simply reserved the Swiss national flag colors when he founded the International Committee of the Red Cross in 1863.

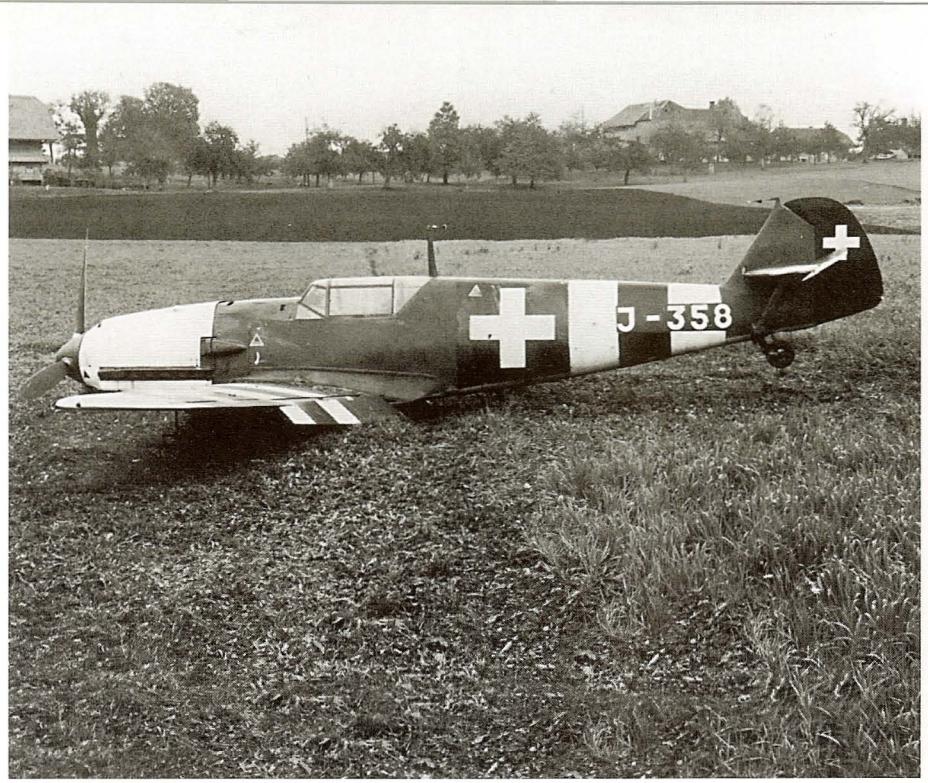
The Swiss outlined the lifting bar attachment aperture Red on their Bf 109E-3s. A bar could be inserted through this hole on both port and starboard sides. This was used in jacking the *Emil* up for inspection. *Hier anheben* (Lift here) is painted in Black to the right of this starboard side hole. (Walter Hodel)





A *Fliegertruppe* Bf 109E-3 is parked at a Swiss airfield in the summer of 1940. The entire rudder is painted Red, with a White cross on both sides. Funnel-shaped covers are mounted on the antenna cable at both the rear and main antenna masts. The engine supercharger inlet protrudes from the port forward fuselage. National markings – a White cross on a Red square – appeared on the fuselages of Swiss Bf 109E-3s from the spring of 1940 until the fall of 1945. (Swiss Air Force Museum via Roland Küng)

This Swiss Air Force Bf 109E-3 (J-383; *Werk Nummer* 2375) nosed over at Buochs Air Base in Central Switzerland on 14 February 1941. This *Emil* was assigned to FlKp (*Flieger Kompanie*; Flight Company) 21. The starboard tire exploded during landing, which resulted in this accident. This mishap damaged 30 percent of the airframe, including the starboard wingtip. Shadows cast by the extended flaps and the drooped elevators create the illusion of a darker undersurface color. *Fliegertruppe* Bf 109E-3s actually had RLM 65 Light Blue undersurfaces. Both radiator exit flaps are closed. Drop-shaped wing bolt fairings are mounted immediately aft of each main gear strut, while the fuel tank cover is located between and slightly forward of these fairings. A fuel drain is located on the port fuselage undersurface, below the fuel tank. Rudder cables were secured to control horns mounted on the rudder. The Swiss repaired J-383 and it went back into service. It was withdrawn from service on 28 December 1949. (Swiss Air Force Museum via Roland Küng)

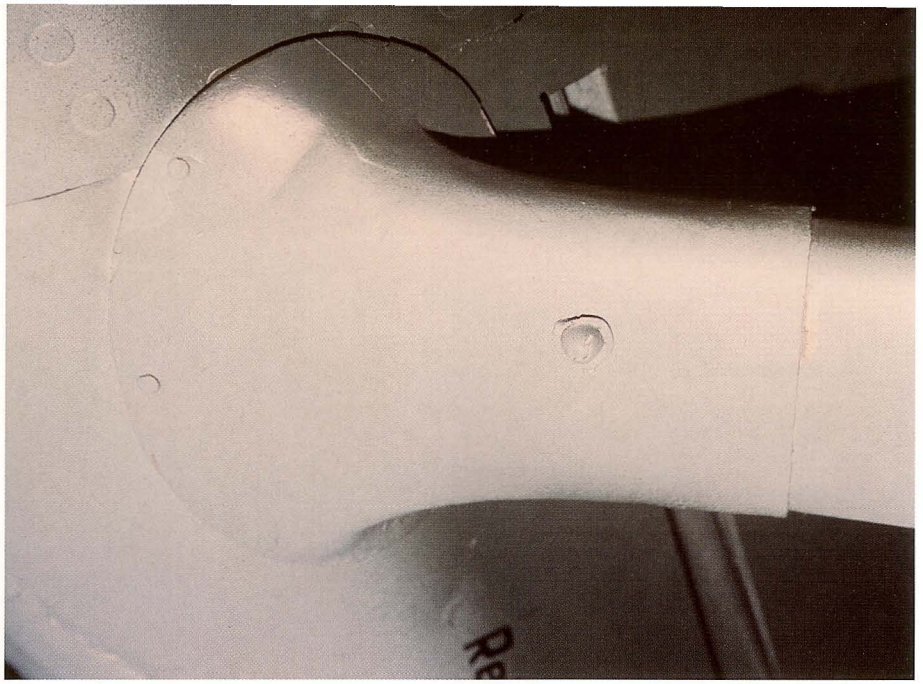


(Above) On 15 September 1944, the Swiss Air Force ordered highly visible neutrality markings painted on all military aircraft, including trainers and interned aircraft under evaluation. These markings were intended to prevent Allied pilots from engaging *Fliegertruppe* Bf 109E-3s. The engine cowling was painted White, while one Red and two White bands were painted on the aft fuselage and on the upper and lower wings. Wing and horizontal stabilizer tips were also painted White. Full neutrality markings were painted on this Bf 109E-3 (J-358; *Werk Nummer* 2425), which made a belly landing after an engine malfunction at Uetendorf, Canton of Berne on 23 October 1944. Swiss *Emils* retained these markings until September of 1945, when the rear fuselage bands were removed. (Swiss Air Force Museum via Roland Küng)

(Above Right) This Bf 109E-3 displays a variation of the neutrality markings. Three White and two Red bands were painted on the aft fuselage and wings, instead of the regulation two White and one Red bands. The scheme was similar to the Black and White 'Invasion Stripes' painted on Allied aircraft for the 1944 invasion of France. The White horizontal stabilizer trim was standard on all Swiss Air Force aircraft, including interned Boeing B-17G Flying Fortress bombers. (Swiss Air Force Museum via Roland Küng)

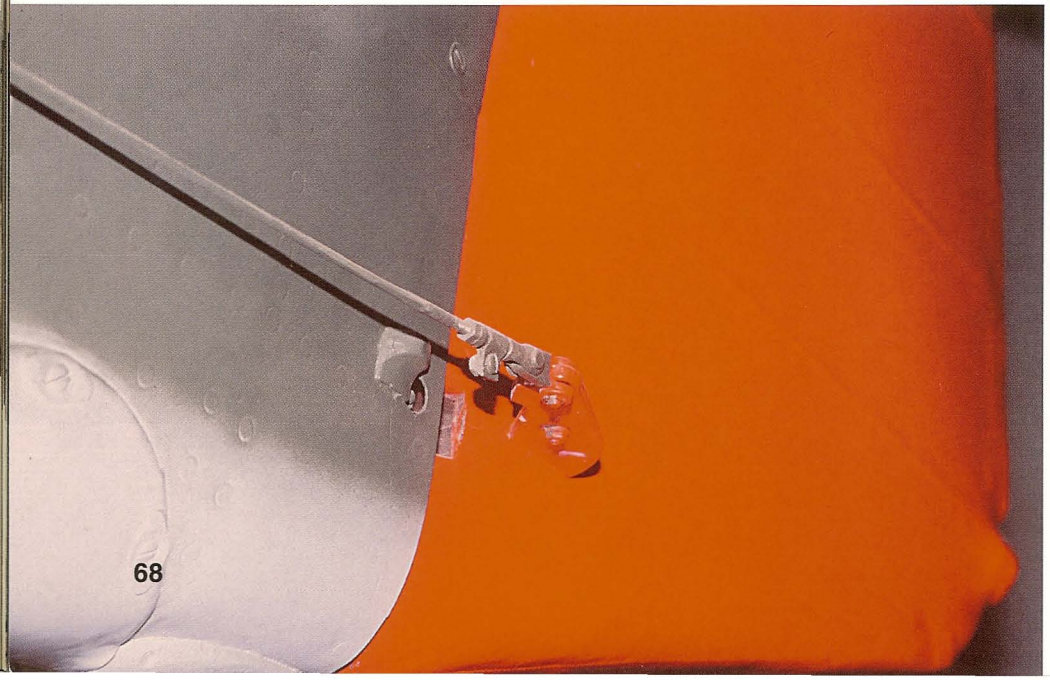
(Right) Correct neutrality markings were painted on this Bf 109E-3 (J-326; *Werk Nummer* 2174), which made a wheels-up landing at Thun airfield on 11 April 1945. Portions of the White and Red neutrality markings show signs of wear. Late in World War Two, the *Fliegertruppe* painted two White stripes on each of the RLM 70 Black Green propeller blades. These stripes warned ground personnel of a turning propeller. (Swiss Air Force Museum via Roland Küng)

A circular rudder cable access hatch is mounted on the aft starboard fuselage. Six screws secured this hatch to the aircraft, rather than the snap-fit latches employed on other *Emil* access panels. The rudder cable access panel is located near the base of the tailplane support strut.

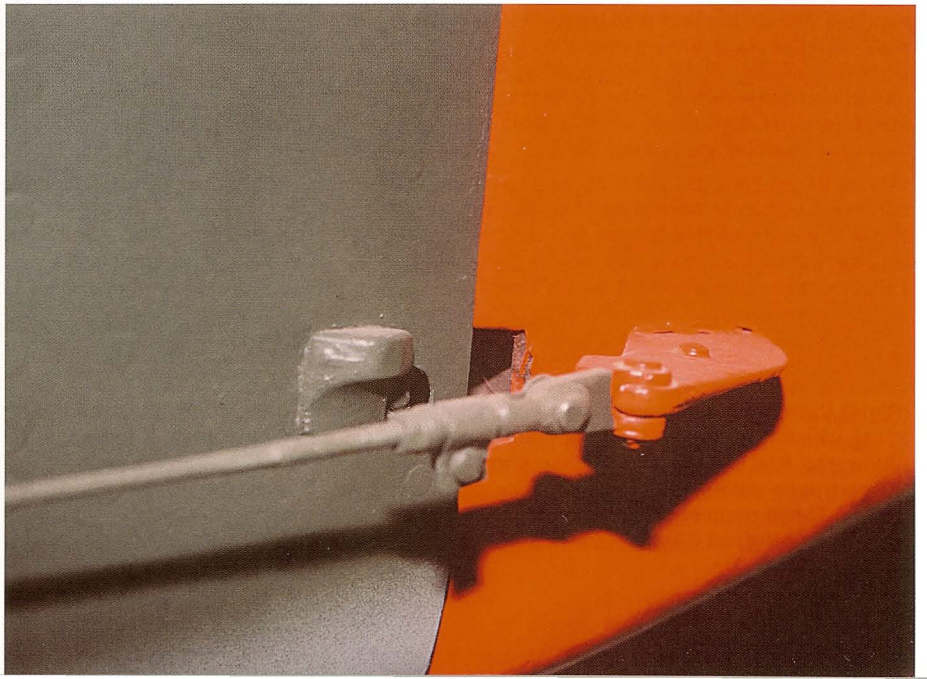


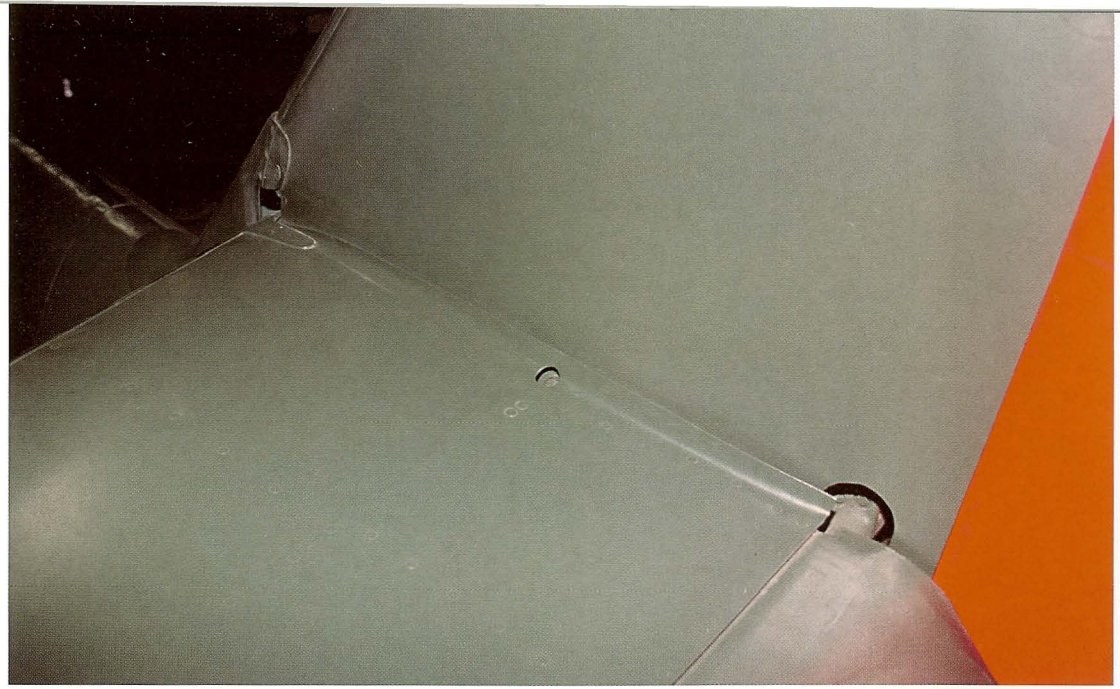
The tailplane support strut is secured to the aft fuselage through a streamlined fairing. Screws and bolts were used to secure this fairing to the fuselage. The Bf 109F and subsequent variants dispensed with this strut.

The port rudder control cable protruded from the Bf 109E-3's aft fuselage. This cable ran from the left rudder pedal in the cockpit to the rudder. An identical cable ran along the starboard side from the cockpit to the rudder.



The rudder cable was secured to a horn on the lower rudder. Bf 109Es and earlier variants employed these externally mounted cables. They were entirely within the airframe on the Bf 109F and subsequent variants.

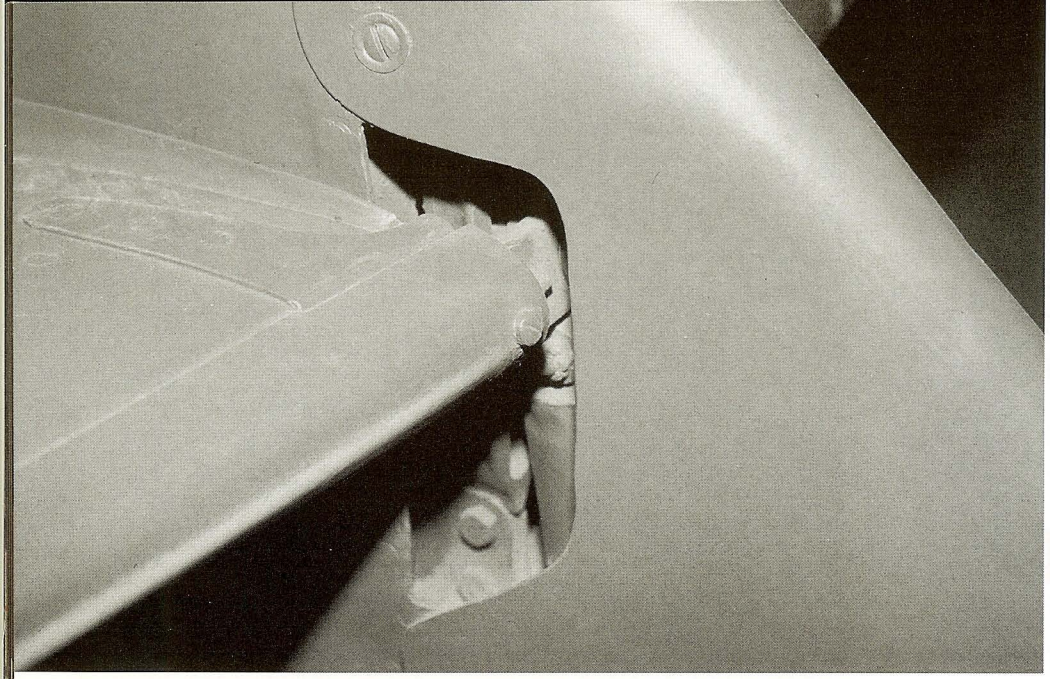




The horizontal stabilizer (tailplane) upper surface curved upward where it met the vertical stabilizer (tailfin). The tailplanes were removed when the aircraft was being transported on the ground or by ship. The elevator torque tube for simultaneous elevator movement protrudes from its aperture at the tailplane's aft end.

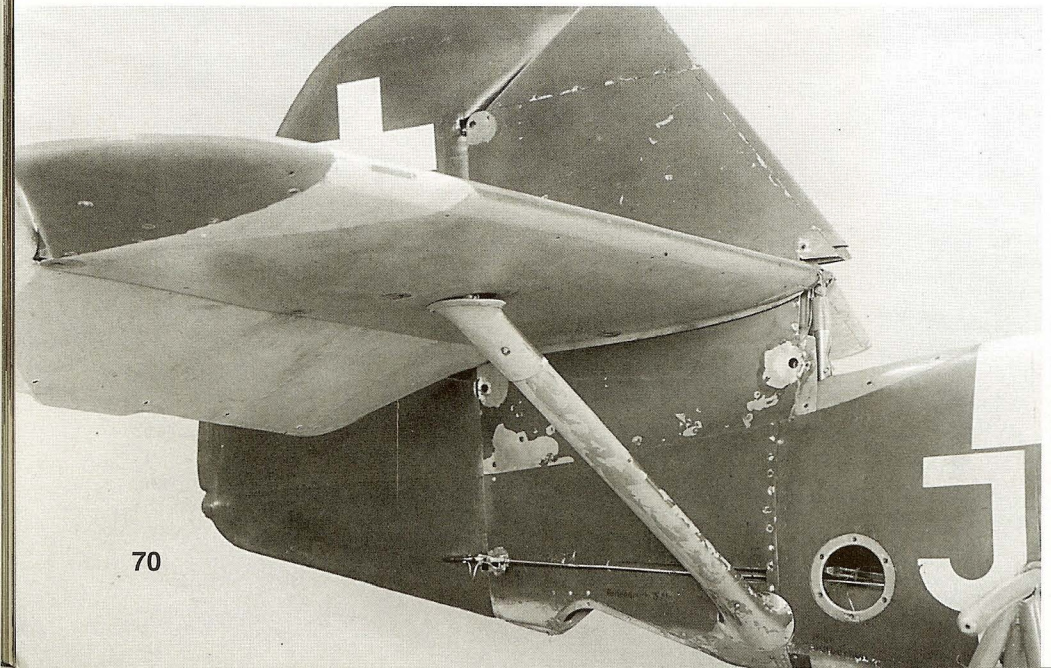
The Bf 109E-3's non-retractable tail wheel was fully castoring. The Swiss Air Force Museum's *Emil* has the original tail wheel and strut, compared to the inaccurate unit on the *Deutsches Museum*'s aircraft. The Yellow arrow painted on the tire and rim indicated the tire air stem.

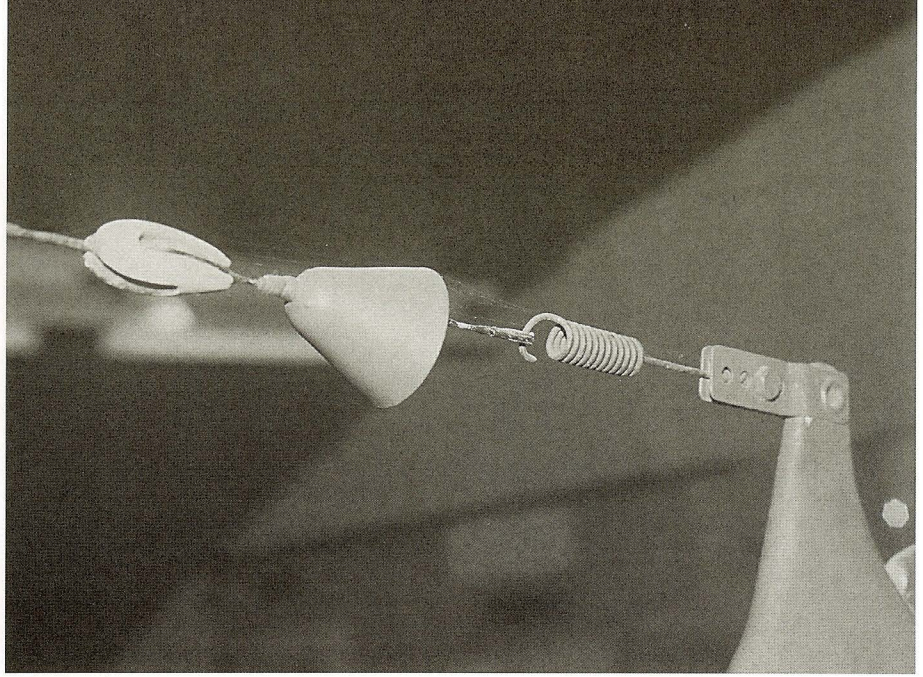
Operational German and Swiss Bf 109E-3s had leather covers over the upper tail wheel strut sections. This cover was removed for servicing the strut leg. The strut was painted RLM 65 Light Blue, while the wheel was Aluminum. Messerschmitt installed a retracting tail wheel on the subsequent Bf 109F, but reverted to the fixed wheel on the Bf 109G.



The tailplane angle was adjusted using this mechanism mounted inside the vertical stabilizer. The pilot moved it +3° to -8° using a hand wheel mounted immediately left of his seat. This adjusted the aircraft's trim under certain weight conditions in flight.

Fliegertruppe personnel jacked up the tail of this crashed Bf 109E-3. Both the adjustable tailplane mechanism cover and the circular access hatch are missing, while the lower tail wheel cover plate section was removed. The pointed White tailplane marking indicated that this *Emil* had neutrality markings; however, part of the tailplane leading edge was not painted White. This edge is believed to be a new part.





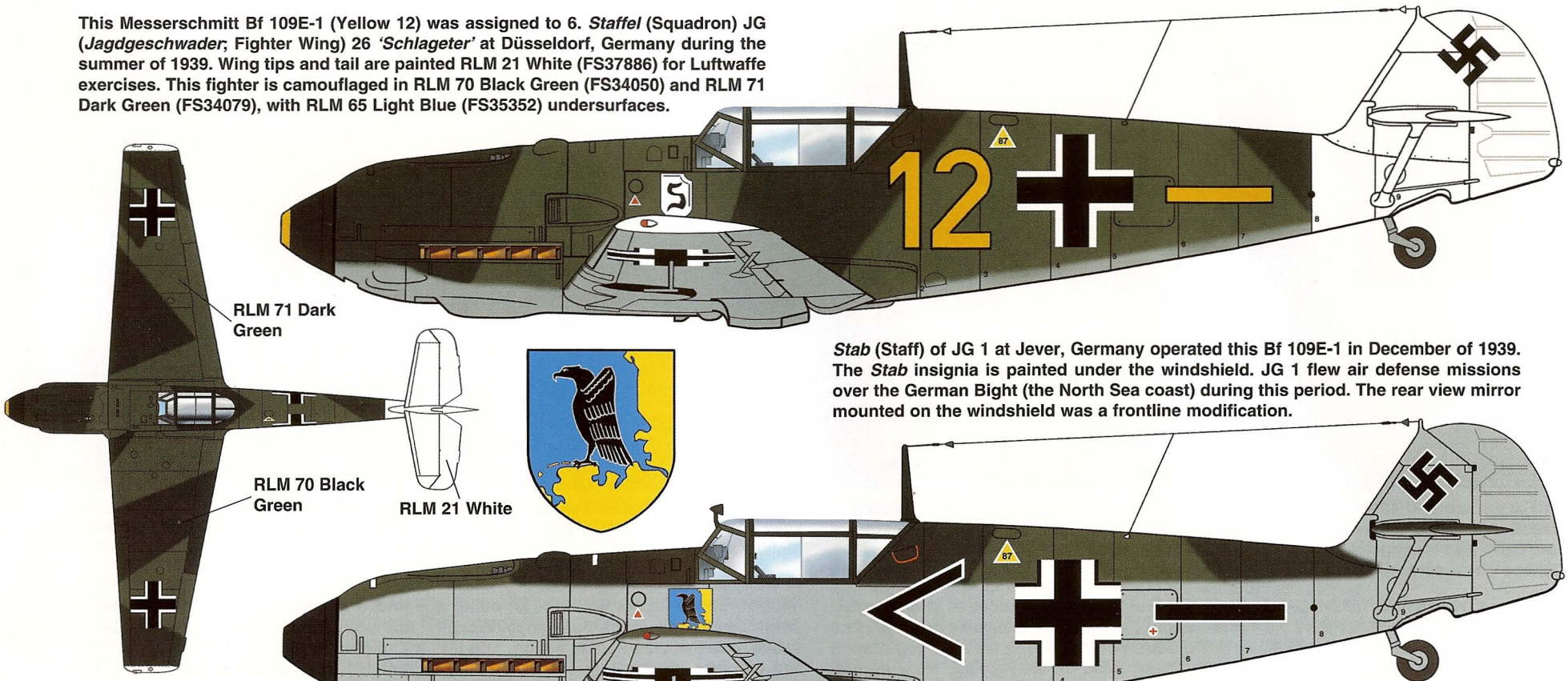
A Bakelite insulator and metal spring fixed the antenna cable to the tail antenna mast. The plastic insulator isolated the antenna cable from the remaining airframe. This restored Swiss Bf 109E-3 has the standard rear antenna cable lay-out for German and Swiss *Emils*. The *Deutsches Museum*'s Bf 109E-3 has an inaccurate rear antenna cable lay-out, since the funnel-shaped covering and the plastic insulator are missing.

The rear fuselage and tail of this Bf 109E-3 (J-357; *Werk Nummer* 2438) were damaged in a wheels-up landing at Kloten Air Base, Switzerland on 19 August 1942. The port first aid and radio access hatch was removed, while the antenna cable had broken after the impact. The antenna cable spring and conical covering are still mounted to the tail mast.

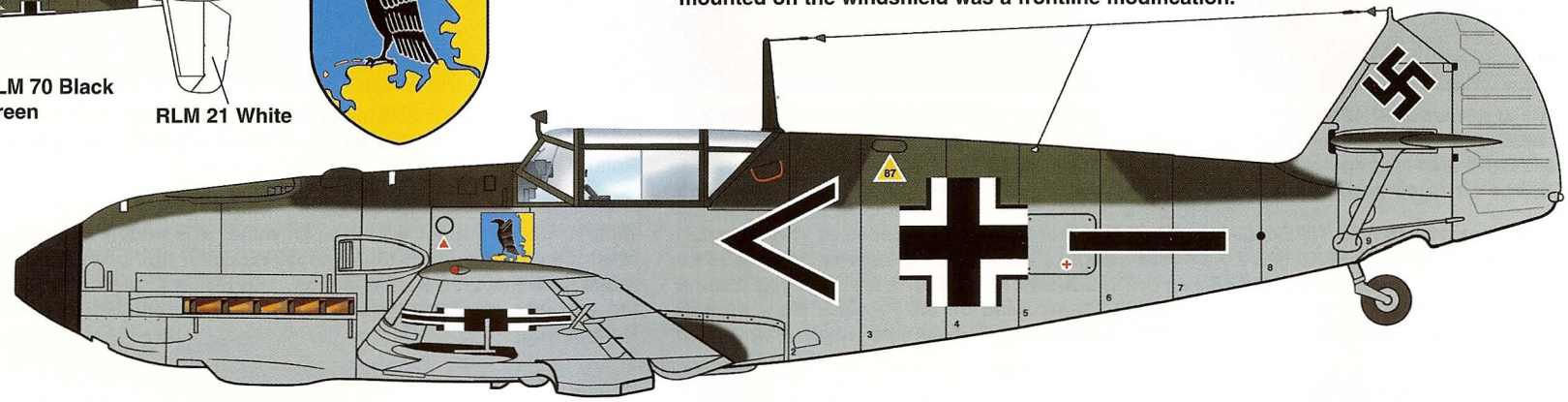
A *Fliegertruppe* Bf 109E-3 (J-327; *Werk Nummer* 2175) rests after a wheels-up landing at Dübendorf Air Base near Zürich on 29 February 1940. This Emil was assigned to FIKp 6 at the time. This was one of the first batch of Bf 109E-3s Germany delivered to Switzerland, whose air force accepted it from Messerschmitt on 27 June 1939. Upper surfaces are painted in the original German camouflage of RLM 70 Black Green and RLM 71 Dark Green upper surfaces, with RLM 65 Light Blue undersurfaces. (Swiss Air Force Museum via Roland Küng)

Another first batch Bf 109E-3 (J-326; *Werk Nummer* 2174) crash landed at Thun, Canton of Berne on 11 April 1945. This *Emil* – then assigned to FIKp 15 – is painted in the full Red and White neutrality markings adopted on 15 September 1944. The fuselage registration number was reduced after national insignia were placed on the fuselage from April of 1940. Simultaneously, the RLM 70/71 upper surface camouflage was replaced by a solid RLM 70 upper surface scheme. An outlet was added to starboard of the main antenna mast immediately aft of the canopy. Propeller tips appear to be worn. Underwing bomb racks were installed on this fighter. The Swiss *Emils* lacked the rear cockpit armor plating that was standard on Luftwaffe Bf 109s from 1940. (Swiss Air Force Museum via Roland Küng)

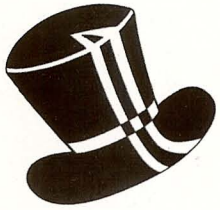
This Messerschmitt Bf 109E-1 (Yellow 12) was assigned to 6. *Staffel* (Squadron) JG (*Jagdgeschwader*; Fighter Wing) 26 *'Schlageter'* at Düsseldorf, Germany during the summer of 1939. Wing tips and tail are painted RLM 21 White (FS37886) for Luftwaffe exercises. This fighter is camouflaged in RLM 70 Black Green (FS34050) and RLM 71 Dark Green (FS34079), with RLM 65 Light Blue (FS35352) undersurfaces.

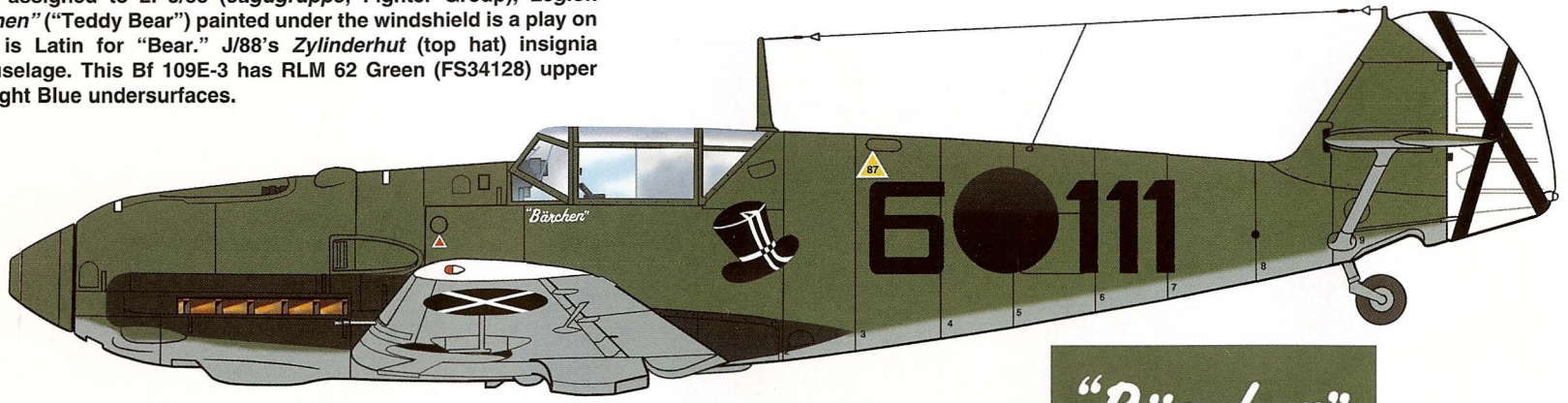


Stab (Staff) of JG 1 at Jever, Germany operated this Bf 109E-1 in December of 1939. The *Stab* insignia is painted under the windshield. JG 1 flew air defense missions over the German Bight (the North Sea coast) during this period. The rear view mirror mounted on the windshield was a frontline modification.



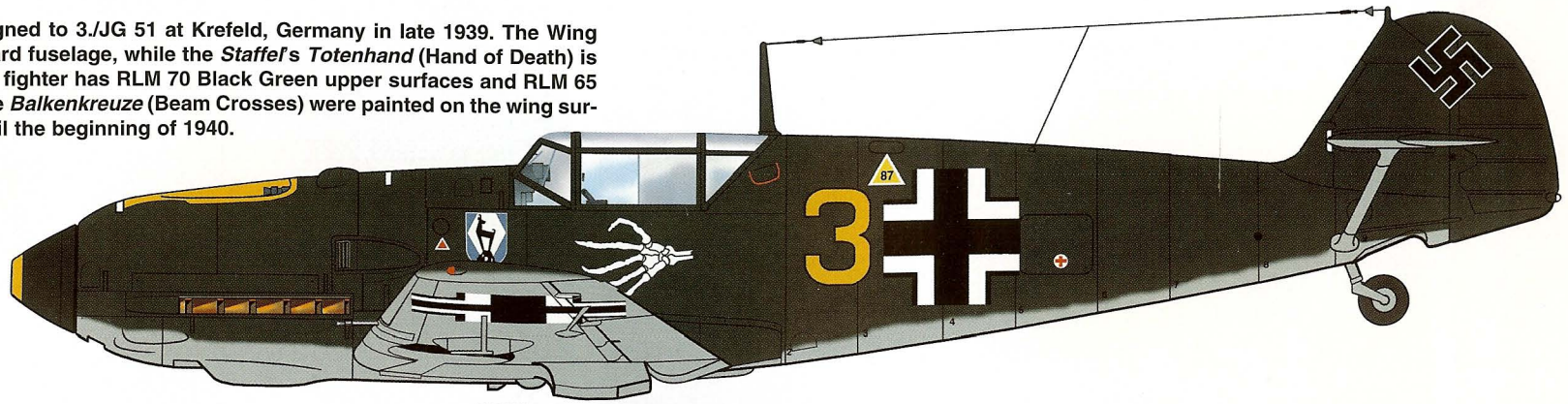
Leutnant (Lieutenant) Werner Ursinus flew this Bf 109E-3 (6•111) in the spring of 1939. The aircraft was assigned to 2. J/88 (*Jagdgruppe*; Fighter Group), *Legion Condor* in Spain. *"Bärchen"* ("Teddy Bear") painted under the windshield is a play on Ursinus' name, which is Latin for "Bear." J/88's *Zylinderhut* (top hat) insignia appeared on the mid-fuselage. This Bf 109E-3 has RLM 62 Green (FS34128) upper surfaces and RLM 65 Light Blue undersurfaces.

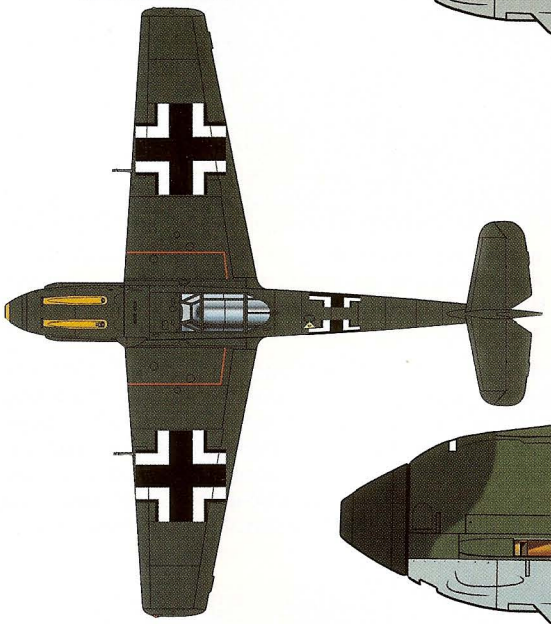


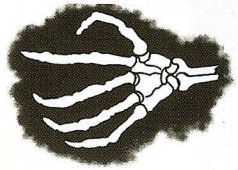


"Bärchen"

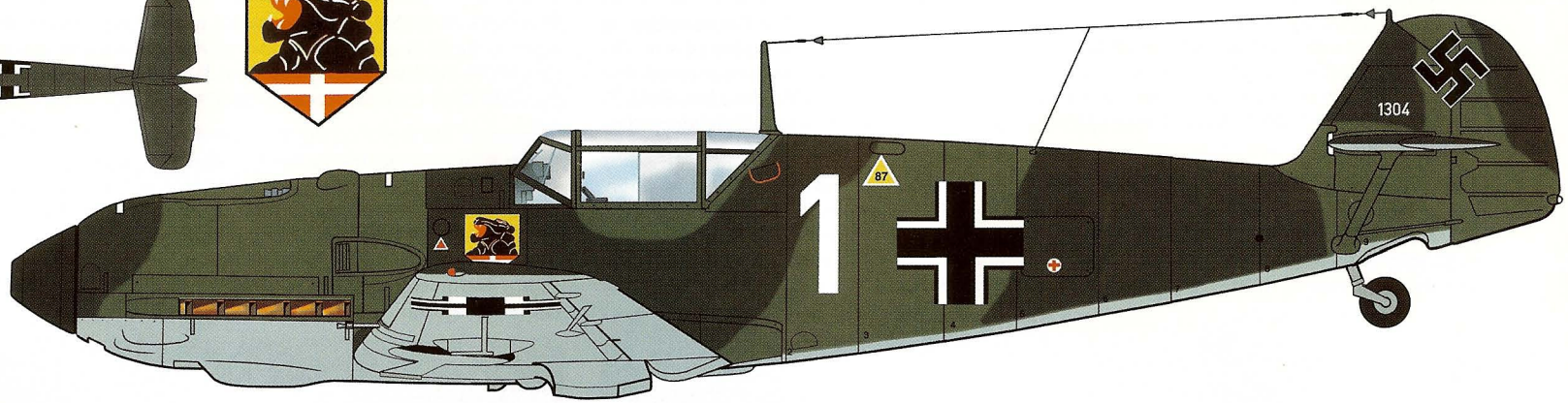
Yellow 3 was a Bf 109E-3 assigned to 3./JG 51 at Krefeld, Germany in late 1939. The Wing insignia is painted on the forward fuselage, while the *Staffel*'s *Totenhand* (Hand of Death) is painted under the cockpit. This fighter has RLM 70 Black Green upper surfaces and RLM 65 Light Blue undersurfaces. Large *Balkenkreuze* (Beam Crosses) were painted on the wing surfaces from October of 1939 until the beginning of 1940.



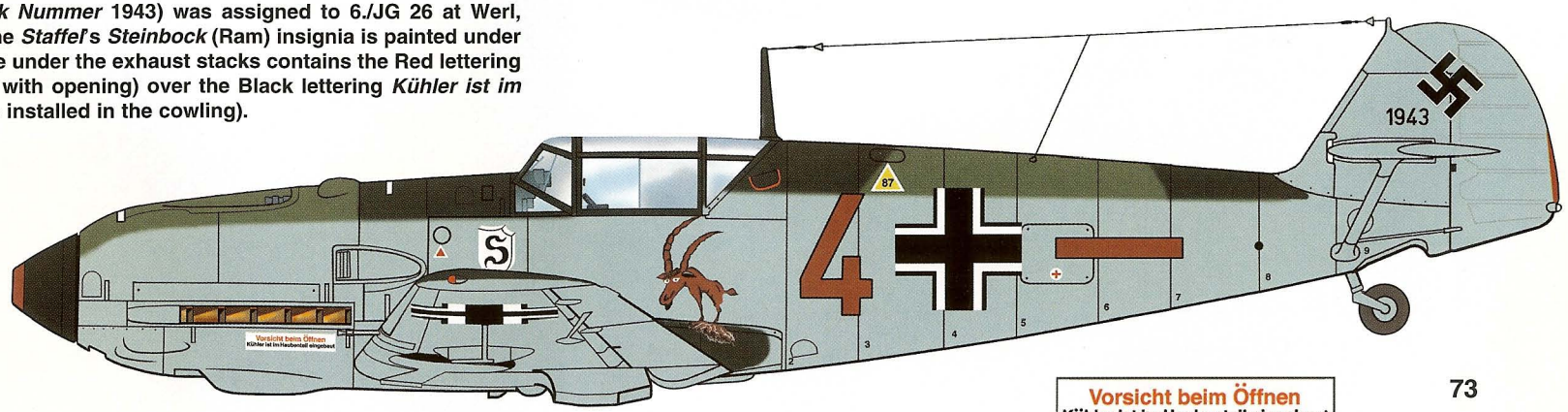




French troops captured this Bf 109E-3 (White 1; *Werk Nummer* 1304) at Woerth, France, where it landed by mistake on 22 November 1939. The fighter was assigned to 1./JG 76 at Frankfurt-Main. The *Geschwader* insignia is painted on the forward fuselage. This *Emil* was later flown to Britain, where the Royal Air Force assigned it the serial number AE479. It later flew tests in the United States before it was destroyed in late 1942.



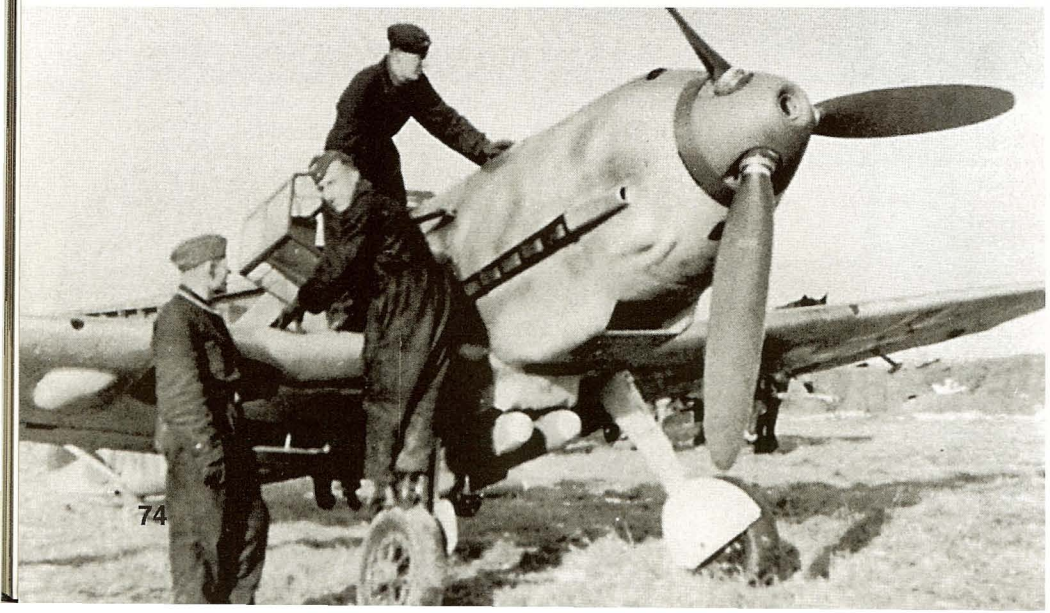
This Bf 109E-3 (Brown 4; *Werk Nummer* 1943) was assigned to 6./JG 26 at Werl, Germany in January of 1940. The *Staffel*'s *Steinbock* (Ram) insignia is painted under the cockpit. The White rectangle under the exhaust stacks contains the Red lettering *Vorsicht beim Öffnen* (Caution with opening) over the Black lettering *Kühler ist im Haubenteil eingebaut* (Cooler is installed in the cowling).



Vorsicht beim Öffnen
Kühler ist im Haubenteil eingebaut

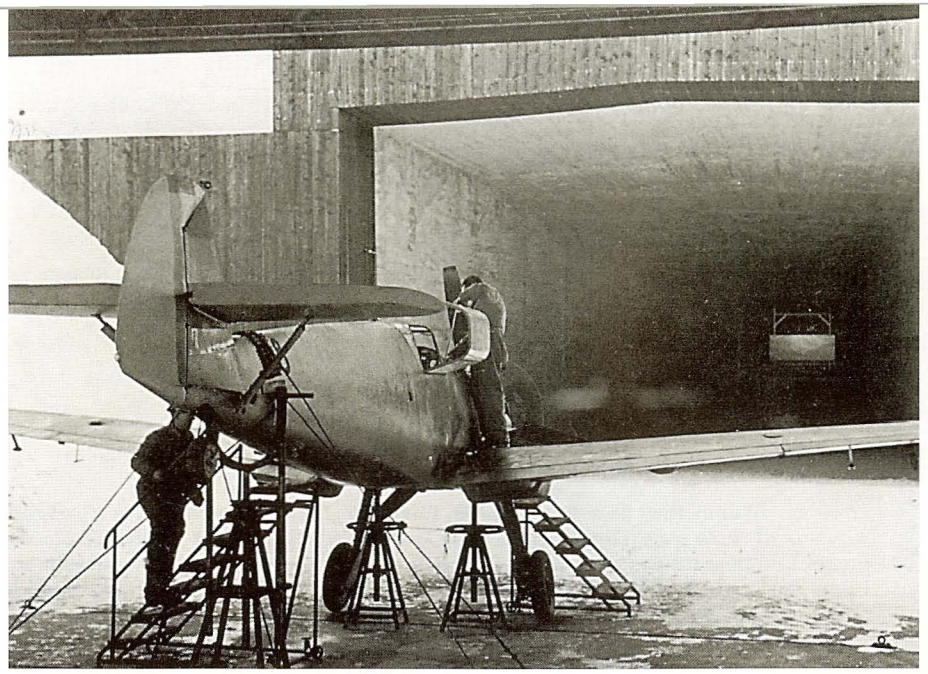
This 2./JG 51 Bf 109E-1 (Red 9; *Werk Nummer* 3326) mistakenly landed at Geutertheim, in the French province of Alsace, on 28 September 1939. The Fieseler-built aircraft was the first intact *Emil* captured by Allied forces in World War Two. French troops pushed this aircraft under some trees to camouflage it from aerial observation. This *Emil* has RLM 70 Black Green and RLM 71 Dark Green upper surfaces extended low on the fuselage sides. (SHAA)

Luftwaffe mechanics prepare a Bf 109E-1/B *Jagdbomber* (Fighter-Bomber) for a mission. A number of Bf 109E-1s were converted into Bf 109E-1/B fighter-bombers. Four 50 KG (110 pound) SC 50 bombs are mounted on an ETC 50/VIIId centerline rack. Additional armor protection was fitted into the center canopy section. Although armed with 7.92MM MG 17s in the wings, this Bf 109E-1/B has the 20MM cannon ammunition bulges. (Manfred Griehl)



Three JG 26 *'Schlageter'* personnel pose before one of their Bf 109E-3s. The *Emil*'s *Werk Nummer* 8943 is painted on the port main wheel shroud, which prevented its unauthorized borrowing by Wing personnel. This *Emil* has RLM 70 Black Green upper surfaces and RLM 65 Light Blue undersurfaces. (Manfred Griehl)

Several Bf 109E-7/*Trop* fighters are lined up in Italy during a stop over on the journey to North Africa. Sand filters are installed on the supercharger intakes on the port cowling and at least two aircraft have a jettisonable 300 L (79 gallon) centerline fuel tank. Tropicalized *Emils* also carried a 7.92MM Mauser *Karabiner* 98k rifle inside the port rear fuselage. Other desert survival items – including potable water, emergency rations, and signaling equipment – were installed on this sub-variant. These Bf 109E-7/*Trops* are assigned to JG 27, which became the first unit equipped with this variant in April of 1941. (Manfred Griehl)

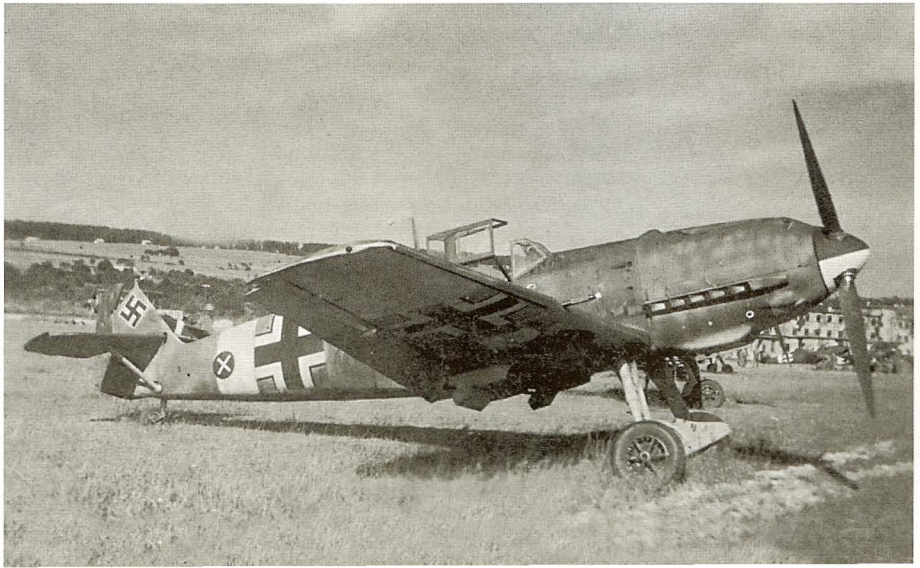


A newly-built Bf 109E-3 is jacked up in front of the shooting tunnel at Messerschmitt's Regensburg factory. Technicians prepare the aircraft for armament tests, when the *Emil*'s guns were fired into the tunnel. The only markings on this aircraft are a Black factory number painted on the rear fuselage. Parts of the vertical tail were not painted RLM 70 Black Green. (*Deutsches Museum*)

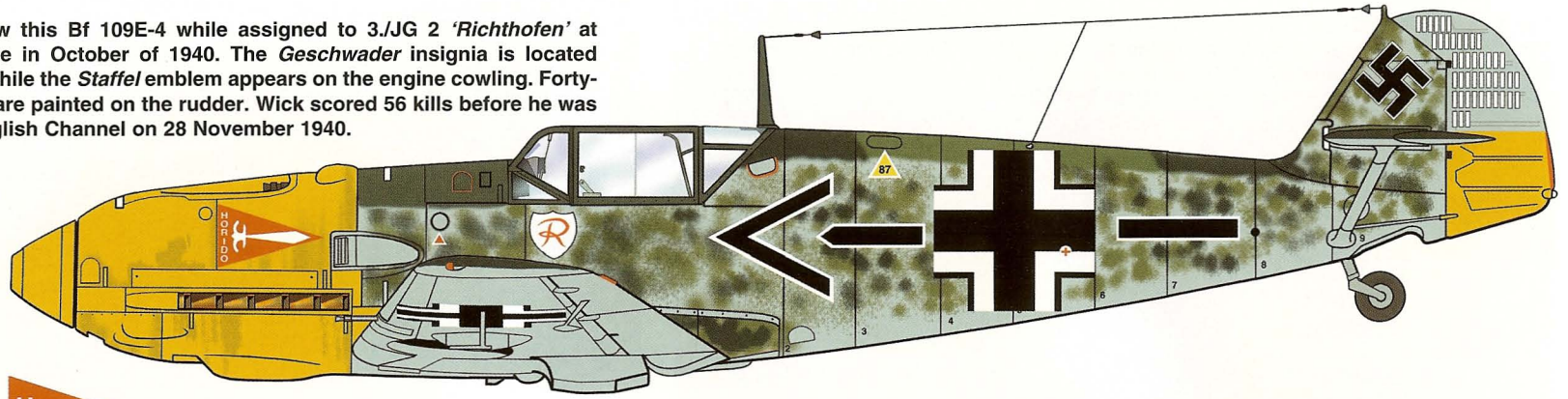
This Luftwaffe Bf 109E-7 was based in Hungary in mid-1941. The propeller spinner is painted Black and White for frontal identification purposes. The RLM 04 Yellow lower wingtips and fuselage bands were typical markings for Eastern Front aircraft. Upper surfaces are RLM 02 Gray and RLM 71 Dark Green, while the RLM 65 Light Blue sides were heavily mottled. A *Spanienkreuz* (Spanish Cross) painted on the fuselage band – a White diagonal cross on a Black disc – recalled the markings on German-supported Nationalist aircraft during the Spanish Civil War. (Ödön Horvath)

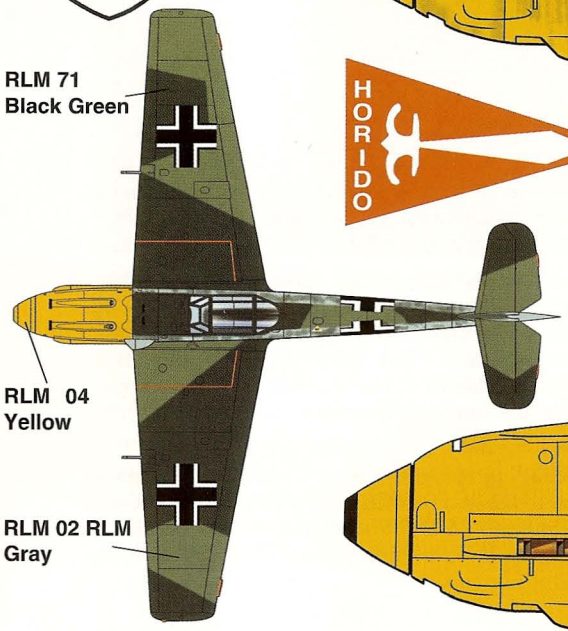
Several Bf 109E-3s are prepared for delivery to the *Aeronautica Regalã Românã* (ARR; Royal Romanian Air Force) in April of 1940. The second aircraft in the right row retains its Luftwaffe markings and Black *Stammkennzeichen* (ferry markings) SK+CJ, but has an RLM 04 Yellow cowling and aft fuselage band. The ARR replaced the Blue (center)/Yellow/Red roundels with the Yellow Michael's Cross national insignia in mid-May of 1941. The Romanian *Emils* have Yellow fuselage numbers, while several have Yellow fuselage bands. (ECPA)

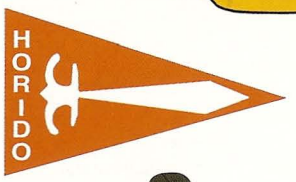
A factory-fresh Bf 109E-4/B *Jagdbomber* is parked at an airfield. Its Black *Stammkennzeichen* (ferry markings) are painted on the rear fuselage and across the lower wing surfaces. *Wiener Neustädter Flugzeugwerke* (WNF) in Austria built this particular *Emil*. Upper surfaces are painted RLM 02 and RLM 71, with mottling on the RLM 65 fuselage sides. (Manfred Griehl)



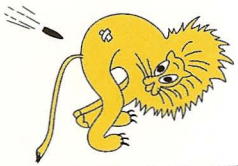
Major Helmut Wick flew this Bf 109E-4 while assigned to 3./JG 2 *'Richthofen'* at Cherbourg-West, France in October of 1940. The *Geschwader* insignia is located under the windshield, while the *Staffel* emblem appears on the engine cowling. Forty-five White victory bars are painted on the rudder. Wick scored 56 kills before he was shot down over the English Channel on 28 November 1940.



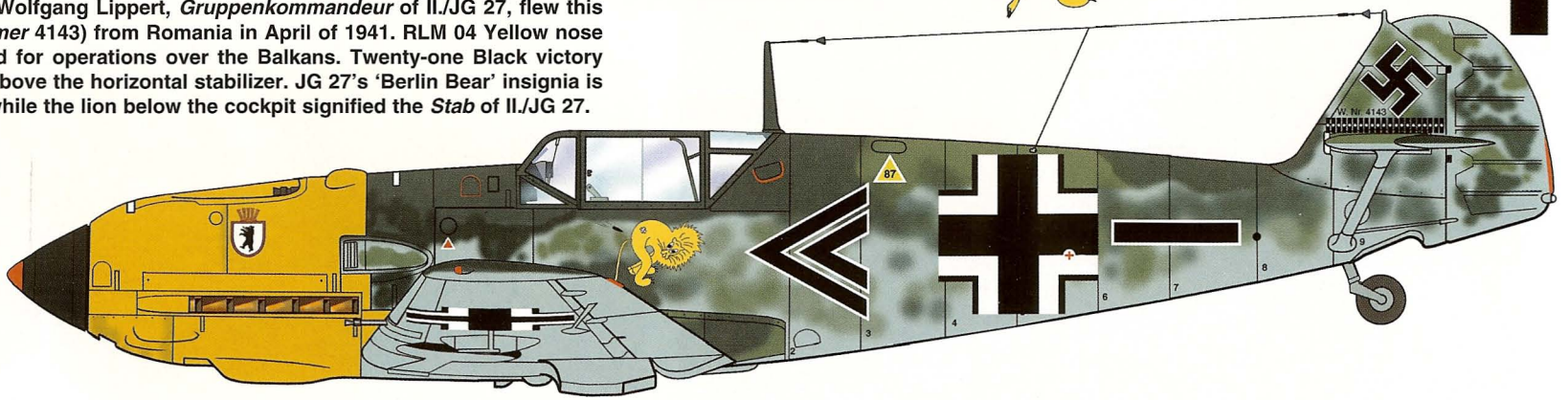




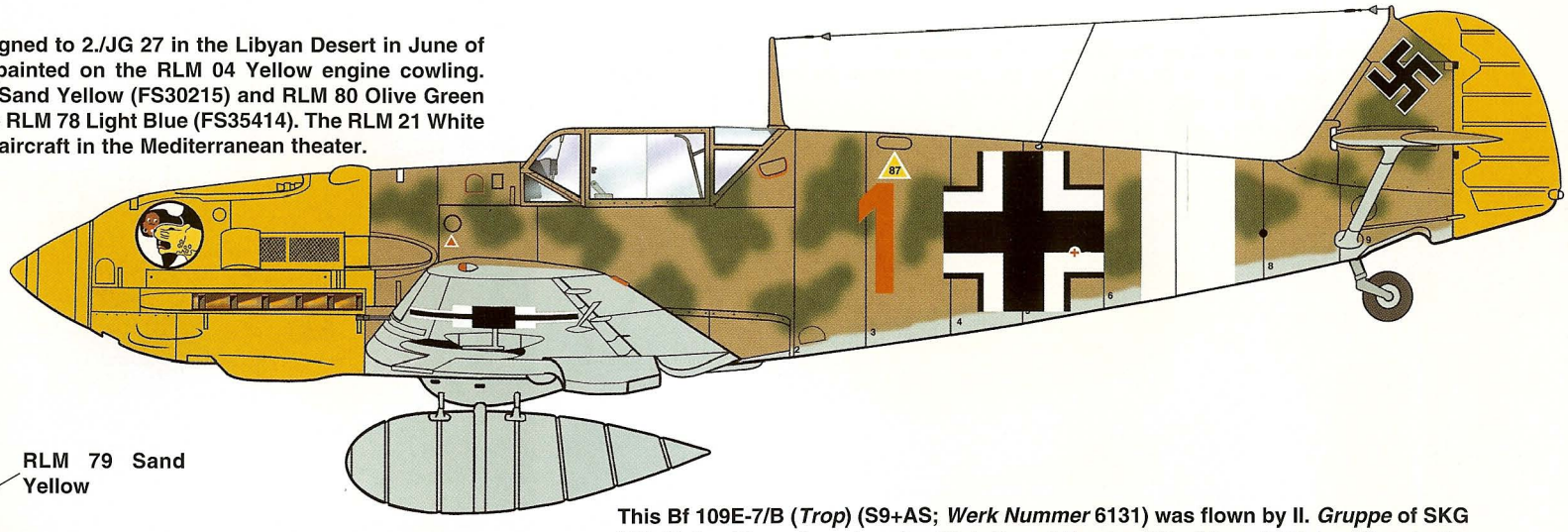
Leutnant Steindl flew this Bf 109E-4/B (Black 5) fighter-bomber while *Gruppen Adjutant* of III. *Gruppe* (Group) of JG 54 in Russia in 1942. RLM 04 Yellow (FS33538) Eastern Front markings are painted on the nose, undersurface wingtips, and rudder. Upper surface colors of RLM 02 Gray (FS36165) and RLM 71 Black Green are painted over the RLM 65 Light Blue fuselage and vertical tail sides.

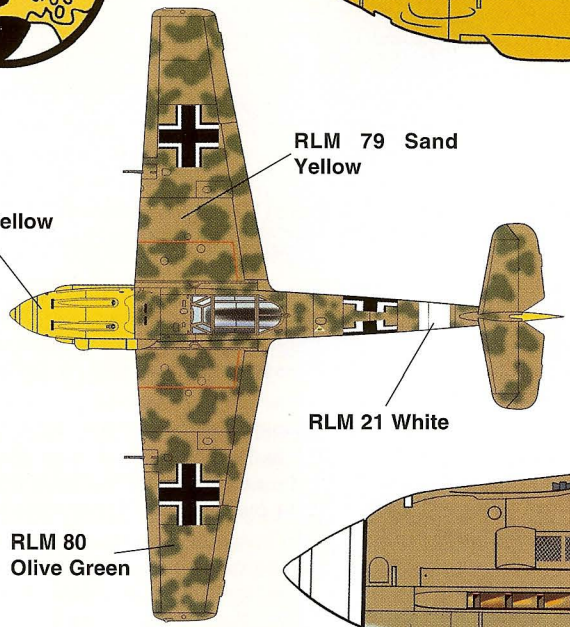


Hauptmann (Captain) Wolfgang Lippert, *Gruppenkommandeur* of II./JG 27, flew this Bf 109E-7 (*Werk Nummer* 4143) from Romania in April of 1941. RLM 04 Yellow nose markings were painted for operations over the Balkans. Twenty-one Black victory bars are painted just above the horizontal stabilizer. JG 27's 'Berlin Bear' insignia is painted on the nose, while the lion below the cockpit signified the *Stab* of II./JG 27.

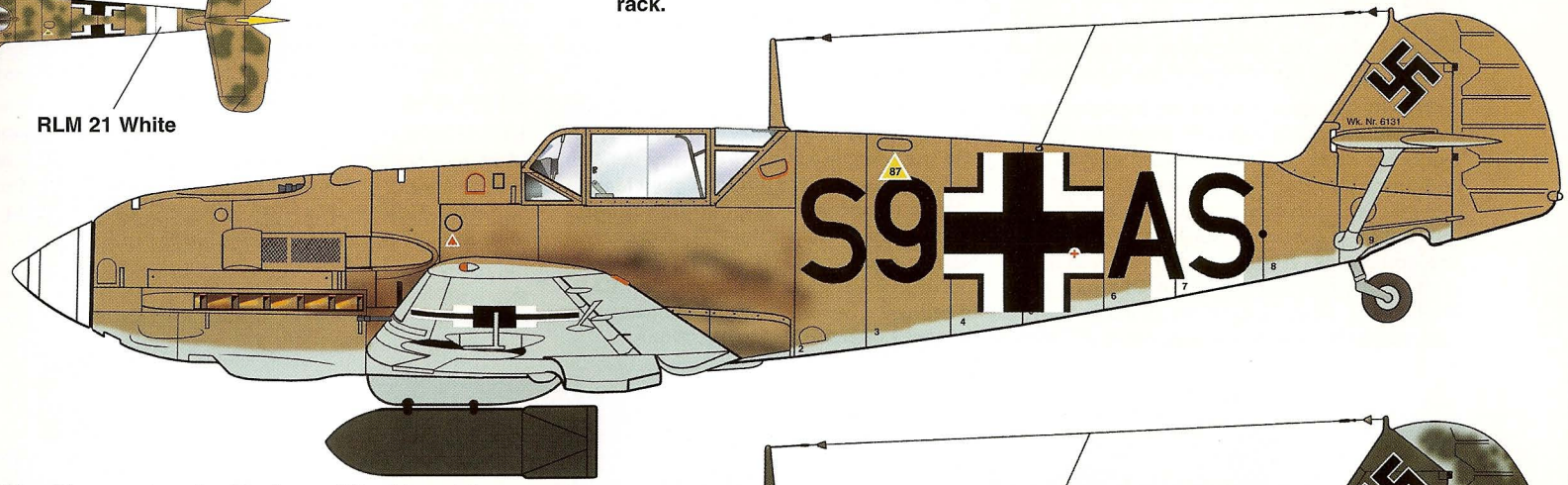


Red 1 was a Bf 109E-7/N (*Trop*) assigned to 2./JG 27 in the Libyan Desert in June of 1941. The *Geschwader* insignia is painted on the RLM 04 Yellow engine cowling. Upper surfaces are painted RLM 79 Sand Yellow (FS30215) and RLM 80 Olive Green (FS34052), while undersurfaces were RLM 78 Light Blue (FS35414). The RLM 21 White aft fuselage band appeared on Axis aircraft in the Mediterranean theater.

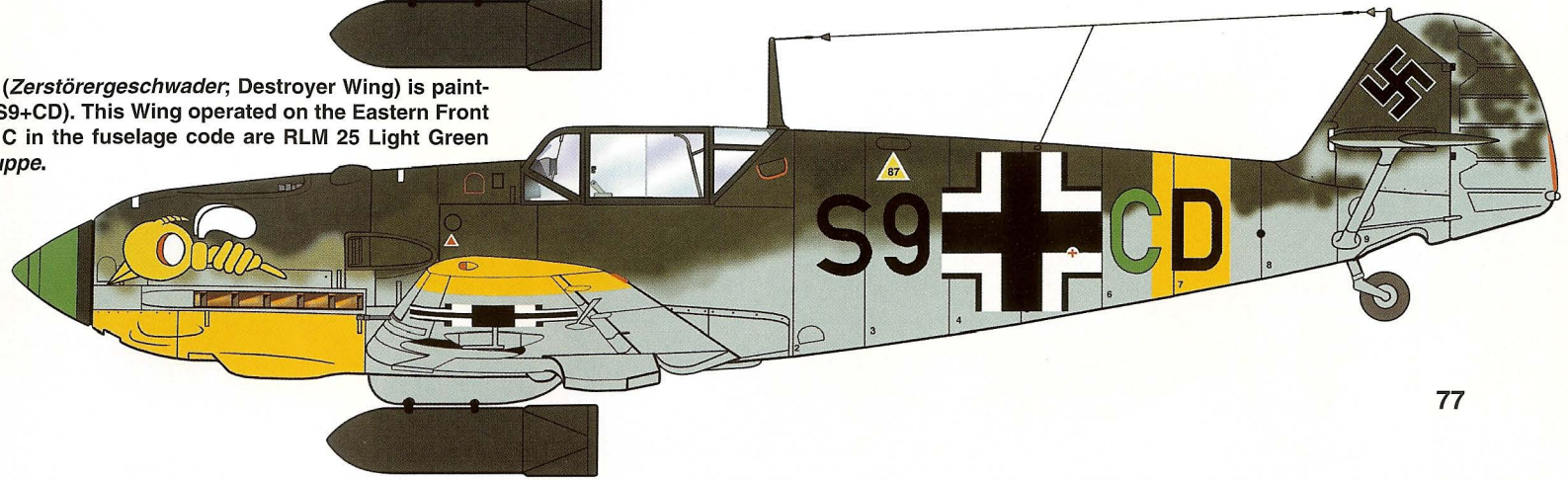




This Bf 109E-7/B (*Trop*) (S9+AS; *Werk Nummer* 6131) was flown by II. *Gruppe* of SKG 210 *(Schnellkampfgeschwader*; High-Speed Bomber Wing) from El Daba, Libya in the fall of 1942. This Wing flew ground support missions for the German *Afrika Korps* in North Africa. A 250 KG (551 pound) bomb is carried on the centerline ETC 500 bomb rack.



The *Wespe* (Wasp) insignia of ZG 1 (*Zerstörergeschwader*; Destroyer Wing) is painted on the nose of this Bf 109E-7/B (S9+CD). This Wing operated on the Eastern Front in 1942. The propeller spinner and C in the fuselage code are RLM 25 Light Green (FS34115), which designated III. *Gruppe*.



Heavy RLM 63 *Lichtgrau* (Light Gray; FS36373) mottling was sprayed over the RLM 70 Black Green upper surfaces of this Bf 109E-3 (Black 6). Undersurfaces were painted RLM 65 Light Blue. The pilot sits in the cockpit on alert and the manual engine starting crank is inserted into the starboard nose aperture. (Manfred Griehl)

A Bf 109E-7/B assigned to SG 1 (*Schlachtgeschwader*; Assault Wing) begins taxiing out for another attack mission over the western Soviet Union in the summer of 1941. A mechanic rides on the starboard wing to help guide the pilot towards the runway. A 58MM bulletproof windshield is mounted ahead of the standard windshield and a Mickey Mouse insignia is painted on the engine cowling. Four Ab 24 containers each carrying twenty-four 2.2 KG (4.9 pound) SD-2 fragmentation bombs were mounted on the ETC 500 centerline bomb rack. These weapons proved highly effective against closely parked Soviet aircraft on their airfields early in Germany's invasion of the Soviet Union (Operation BARBAROSSA), which began on 22 June 1941. *Emils* primarily served in the fighter-bomber role during the war in Russia, while Bf 109Fs flew most Luftwaffe fighter missions.

One of 19 ex-Luftwaffe Bf 109Es transferred to the *Vzdusne zbrane* (Vz; Slovak Air Arm) rests at Piestany (Bad Pistyan), Slovakia in October of 1942. A temporary German civil registration (D-Ixxx) was painted on the rear fuselage and wing undersurfaces for the ferry flight from Grove, Denmark to Slovakia. The Vz assigned this *Emil* to *Letka* 13 (13th Squadron) at Piestany. (Andrzej Morgala)

French personnel inspect a captured Bf 109E-1 (White 6; *Werk Nummer* 3247), which had been assigned to 1./JG 76 at Frankfurt-Main, Germany. The Fieseler-built *Emil* fell into French hands at Marne, France on 30 May 1940. French roundels replaced the fuselage and wing *Balkenkreuze*, while the tail swastika was overpainted. A rear view mirror was mounted on the canopy frame. (SHAA)

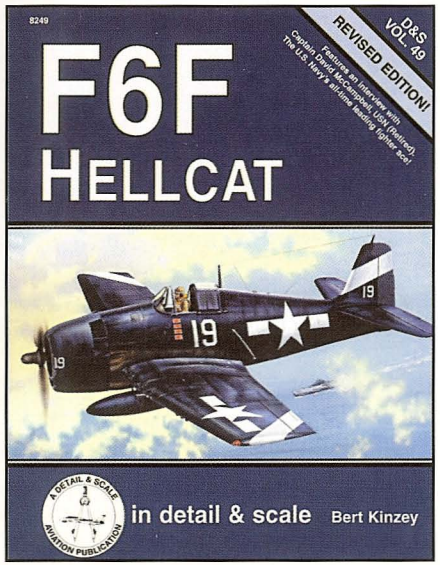
A Bf 109E-3 (Black L-7; *Werk Nummer* 2507) of the 32 *Lovacka grupa* (32nd Fighter Group), *Jugoslovensko Kraljevsko Ratno Vazduhoplovsto* (JKRV; Yugoslav Royal Air Force) taxis at Zemun Air Base. The aircraft was painted with RLM 70 Black Green upper surfaces and RLM 65 Light Blue undersurfaces. The *Kosovski krizevi* (Kosovo crosses) national insignias only appeared on the wing upper and lower surfaces. All 73 Yugoslav Bf 109E-3s were built at Regensburg and delivered with German civil registrations in 1939 and 1940. Only 43 JKRV *Emils* were available when German forces invaded Yugoslavia on 6 April 1941. (Milan Micevski)

A VV Bf 109E-7 (White 1) is parked on a Bulgarian airfield in early 1945. It is painted with the revised national insignia adopted after Bulgaria changed from the Axis to the Allies on 9 September 1944. The tail was striped (from top) Wlage roundel consisted of a Green bar across a Red center disc and White outer ring. White patches were sprayed over the upper surface camouflage – believed to be RLM 74 *Graugrün* (Gray Green; FS34086) and RLM 75 *Grauviolett* (Gray-Violet; FS36122) – for winter camouflage. (Stephan Boshniakov)

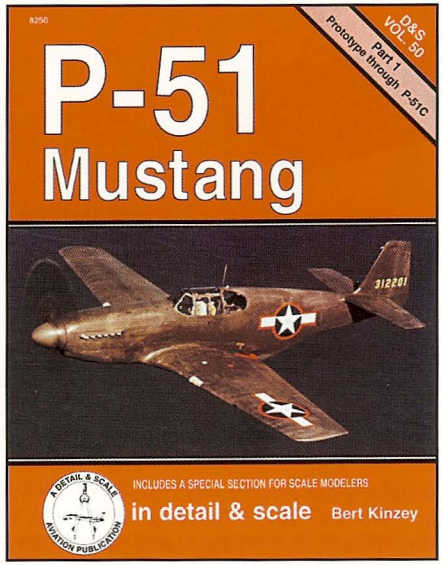
Germany delivered 19 Bf 109E-4s to the *Vazdushni Voyski* (VV; Royal Bulgarian Air Force) in 1940 and 1941. These were built at WNF in Austria and assigned to the 3rd *Yato* (Squadron), 2nd *Istrebiotelen Orliak* (Fighter Battalion) at Karlovo. The aircraft number 7 was Black on the lower wing surface and White on the aft fuselage. The national insignia – a Black diagonal cross on a White square – appeared on the wings and fuselage. VV Bf 109E-4s had RLM 70 Black Green upper surfaces and RLM 65 Light Blue undersurfaces. (Stephan Boshniakov)

This Bf 109E-3 (Yellow 33; *Werk Nummer* 2434) was assigned to *Grupul 7 vânãtoare* (7th Fighter Group), ARR (Royal Romanian Air Force) at Pipera-Bucharest airfield, Romania. The Group's Donald Duck insignia is painted near the RLM 04 Yellow aft fuselage band. An unknown disc insignia appears on the vertical stabilizer. The Germans supplied 50 Bf 109E-3s – primarily refurbished Luftwaffe aircraft – to Romania in 1940 and 1941. (Dan Antoniu)

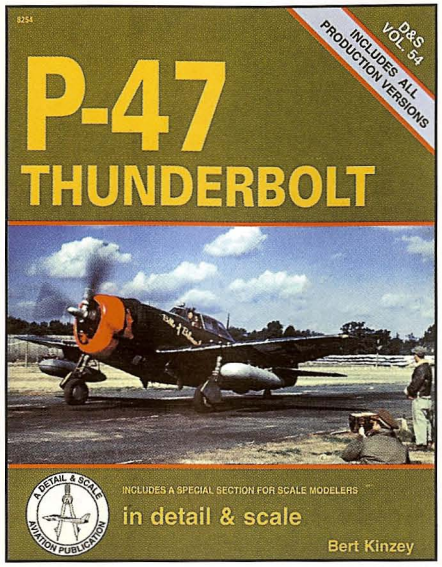
World War Two Fighters from Detail & Scale



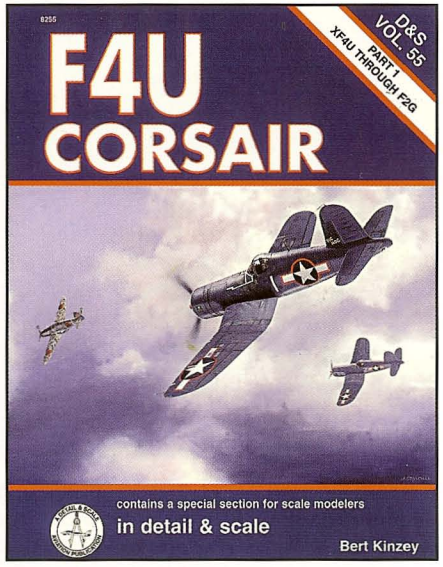
8249 F6F Hellcat



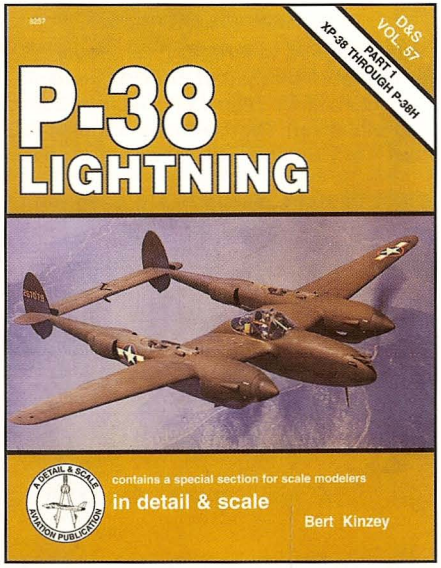
8250 P-51 Mustang, Part 1



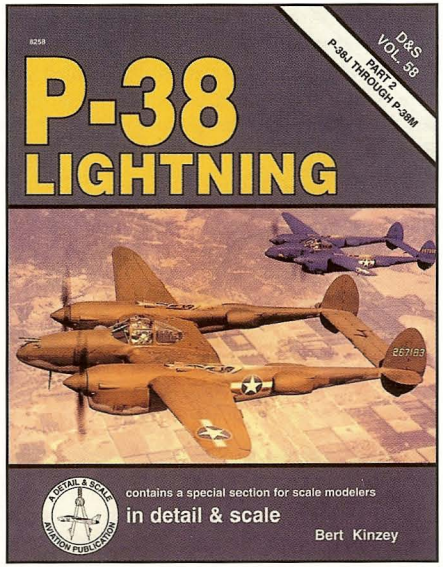
8254 P-47 Thunderbolt



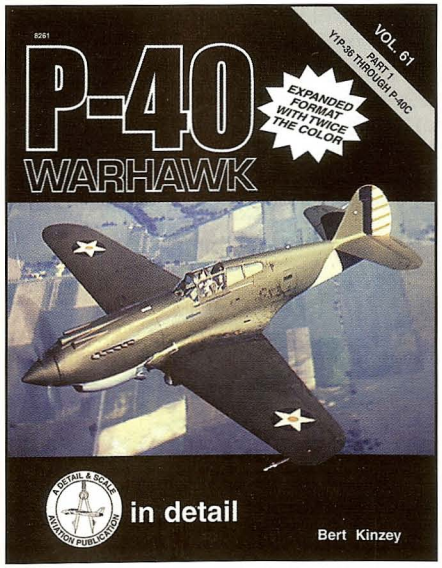
8255 F4U Corsair, Part 1



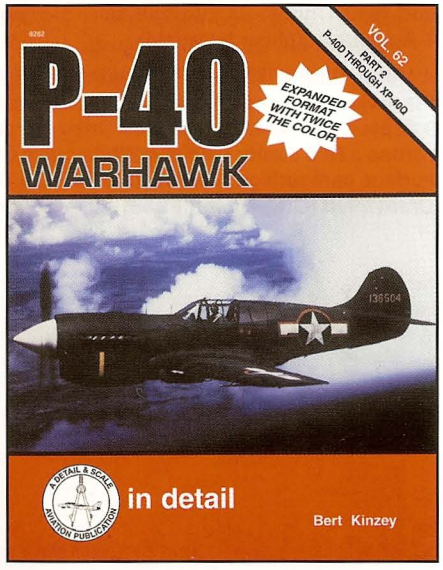
8257 P-38 Lightning, Part 1



8258 P-38 Lightning, Part 2



8261 P-40 Warhawk, Part 1



8262 P-40 Warhawk, Part 2

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